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DEPARTMENT OF AGRICULTURE.

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QUESTIONS AND ANSWERS

RELATING TO

Agricultural and Horticultural Subjects.

BY

THOS. J. EDGE, *Secretary*,
DEPARTMENT OF AGRICULTURE,
HARRISBURG, PA.

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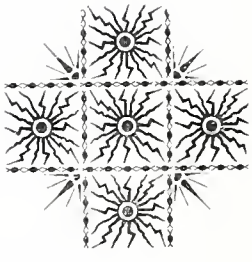


PREFACE.

COMMONWEALTH OF PENNSYLVANIA,
DEPARTMENT OF AGRICULTURE.
HARRISBURG, PA., December 1, 1898.

At the Farmers' Institutes held under the auspices of the Pennsylvania State Board of Agriculture and the Department of Agriculture, the "Question Box" has always been considered as an important integer in the institute work, and one which has invariably received the heartiest approval and warmest recognition for the genuine good which has resulted from the discussion of live and valuable subjects relating to the great agricultural and horticultural resources of Pennsylvania.

The questions which were placed in the box at institutes were, in many instances, preserved, and the following answers were prepared by the Secretary, for publication, at the office of the Department, after the close of the institute season. They should in no instance be understood to be the exact answers given at the institutes where the questions were propounded, as in such cases many of the questions asked were answered by others present at the sessions.

Respectfully yours,

THOS. J. EDGE,
Secretary.

FERTILIZERS AND FERTILITY.

"In his address this morning Secretary Edge stated that one ton of butter only removed forty cents worth of fertility from the soil, while the milk from which the butter was made would, if sold off the farm, remove more than thirty-five dollars worth of fertility: what did he mean?"

All crops produced on the farm may be divided into two distinct classes of elements one of which is derived from the soil and can only be obtained from the soil, while the other comes from the atmosphere; the elements taken from the soil are the only ones which we need value as those from the atmosphere practically cost nothing and do not have to be replaced to keep up the fertility.

Of the elements derived from the soil all exist in sufficient abundance except phosphoric acid, potash and nitrogen and even the latter may be obtained from the atmosphere through the clover plant. Chemists assign to each of these elements a fixed commercial value and if the phosphoric acid, potash and nitrogen in a ton of butter are thus valued they can be replaced by a commercial fertilizer for about fifty cents; that is, all of these elements which two thousand pounds of butter contains may be purchased for this amount.

If all of the phosphoric acid, potash and nitrogen in twenty-three tons of milk (required to make one ton of butter) is valued in the same manner they will amount to more than fifty dollars and if the milk is sold and the skim-milk not brought back, all go off the farm. Where the butter is made on the farm the skim-milk is kept there and theoretically at least, all of its phosphoric acid, potash and nitrogen is returned to the soil in the manure. The elements which come from the soil are the ones which must be replaced or the fertility of the soil must suffer.

"How can yard manure be best applied to benefit the clover crop?"

If benefit to the clover crop is the sole object in view, there is probably no better plan than to spread the manure directly on the

clover sod, care being taken not to apply it thickly enough to smother out the clover and prevent its growth. For this purpose moderately well rotted manure is best, and it is simply a question whether this manure may not have lost so much during the process of partial decay to adapt it for use on the clover, as to effectually destroy all possible profit that may arise from the protection afforded by the manure. This surface application is excellent in protecting the young clover from freezing and thawing, and also from being burned out by the hot sun and dry weather.

"Is sub-soiling profitable?"

So far as known, except in special cases and for special purposes, sub-soiling has not been continued for any great length of time. Numerous cases are upon record in which it was commenced in ordinary farm culture, but the practice was only continued for a few years, presumably because it was not found to be profitable. It is quite probable that it was found that the amount which the sub-soiling cost in addition to ordinary plowing, would, if expended for fertilizers or other forms of fertility, pay much better. At any rate, the experiments do not appear to have been continued long.

"What is the 'Natural Plant Food' so extensively advertised in some sections of the State?"

"Natural Plant Food" is a softer grade of phosphatic rock somewhat similar to the South Carolina Rock, but is obtained in Florida; the rock is ground to a very fine powder but is not treated with acid as is the South Carolina Rock; as a natural consequence its phosphoric acid is in combination with lime in the form known to chemists as "insoluble," but it is claimed by those who offer it for sale that the term "insoluble" as applied to the phosphoric acid in natural plant food must be taken with the same meaning as when applied to the phosphoric acid as it exists in raw bone, or in other words, that although not in the form known as "available" it is really in a form which slowly becomes available as plant food. The question then which presents itself to the farmer, admitting the claim of the manufacturers to be correct, is whether he had better apply the natural plant food and wait for its action or use Dissolved South Carolina Rock and have immediate action; like all other questions in the application of a fertilizer, it is one of dollars and cents, or rather one of cost.

Its use is thus far an experiment, and we would advise farmers to purchase cautiously as they would of any new candidate for public favor, and not too quickly substitute it for fertilizers the action of which they understand and know well. Try it in small amounts and apply alongside an equal value of Dissolved South Carolina Rock and be governed in future purchases by the results attained by your own practical experiments, remembering that the results on adjoining land may in no way govern or indicate the results obtained on your own land.

"Will the application of wood ashes produce scab in potatoes?"

Inasmuch as the disease known as scab is produced by or from a distinctive germ it naturally follows that if this germ does not exist in the soil, wood ashes cannot produce it; in fact, it is claimed by many that the application of potash in any form and especially in the form of wood ashes, will prevent the increase of scab and that, while it will not entirely prevent it, it will circumscribe its spread to greatly decrease the damage and loss inflicted.

The scab may be taken to the field in many unsuspected ways; if scabby potatoes are fed to pigs or cows the chances are that many of the germs will escape the action of the digestive organs and fluids and remain in the manure; in this manner they may be and undoubtedly are taken out to the field, and once introduced there in any manner, their spread is merely a question of surroundings, such as season, moisture, character of the soil and condition of the plants.

In many cases the germs of the disease are taken to the patch with the seed which is planted, or it may be taken by the baskets or bags in which the seed is carried or from which it is dropped in the furrow.

If in any manner the germs of the scab have been introduced in the soil it is extremely difficult to get rid of them and the only practical plan seems to be to abandon the cultivation on that ground of any crop which will propagate the disease. In practice it appears for many years, and springs into active life when potatoes are again planted.

"From whence does a plant obtain its nourishment before the stalk gets above ground?"

A plant cannot obtain any nourishment or food from the soil until it has leaves or, in the case of a few plants, a thick green stem, through which it can change the character of the plant food brought up by the roots and prepare it for actual plant food. Until the

plant has these leaves or this green surface which represents its lungs, it must obtain its nourishment from the material stored up in the seed or cutting planted.

In the first process of sprouting, roots having the power of collecting moisture are thrown downward and in all directions and the substance of the seed or cutting thus dissolved is conveyed to the proper organs of the plant and furnishes the nourishment which enables it to throw out its true leaves. After these have been formed, the sap loaded with immature and imperfect plant food makes the circuit to the leaves and by the absorption of certain materials from the atmosphere and by giving off others, becomes fitted to enter the circulation as food and nourishment.

In the case of a potato cutting, it has been found that, in a few cases, the formation and outline of the original cutting has not been changed but it does not follow from this that the young potato plant has reached the surface by means of food from the soil. A careful chemical examination of the cutting will always show that its character has been changed and a portion of its structure absorbed by the tiny plant and converted into tissue for increasing its growth and the formation of leaves.

"What is the value of chicken manure, and what is the best method of preserving its value?"

The value of chicken manure, like that of all natural fertilizers, depends upon the manner in which the fowls have been fed and the manner in which the manure has been taken care of. Analyses made by the Board indicate that it may range anywhere from $31.66 to $3.75 per ton, depending largely upon the manner in which it was treated.

The following analyses show the results from three samples sent to the chemist of the Board:

Number.	Moisture.	Available phosphoric acid.	Potash.	Nitrogen.	Commercial value per ton.
1,.....	7.55	1.11	1.30	3.55	$15 76
2,.....	3.31	.93	.59	.85	4 82
3,.....	8.78	4.36	1.64	6.04	29 08
Average, ...	6.55	2.13	1.18	3.47	$16 62

No. 1 was taken directly from the chicken house before it had time to lose much of its nitrogen; No. 2 was, practically, the same manure, but was one year old and had been kept in a box under roof but not specially protected from the action of the air; No. 3 was sent by a member of the Board who is noted for the character of his

poultry and their eggs, and was taken directly from the floor of the chicken house, as its percentage of moisture shows.

The three samples give an average value of $16.62 per ton, and, considering the character of No. 3, this is evidently too high for the average sample, as chicken manure is usually cared for by farmers. In fact, it is quite probable that sample No 2 more nearly represents the average of chicken manure as it is applied to farm crops.

A comparison of the samples would indicate that by exposure to the air, No. 2 had lost by far the larger and most valuable portion of its nitrogen, and that the loss may be measured by the figures for nitrogen of 3.55 in No. 1 and 0.85 in No. 2.

The best method of preservation is probably to occasionally cover the manure as it is made in the chicken house, with dry road dust, dried clay, or in the absence of these, with dry coal ashes which contains so little alkaline properties as not to be dangerous. For this purpose there is probably nothing better than dry road dust applied at least once each week. A still better plan would be to remove the manure once each week and place it in barrels or boxes, each layer being well covered with dry road dust, dry clay or a similar material.

The addition of common land plaster will also have a tendency to lock up and preserve the nitrogen which would otherwise probably be lost, but it should be remembered that plaster only has the power to fix nitrogen when in the presence of considerable moisture, and that if applied to the dry chicken manure, it may have but little effect.

Chicken manure should never be placed so that it will come in contact with the seed, as its nitrogen is in such a soluble form that a slight rain after seeding may, and often does, injure the seed and prevent its growth, and even after the stalk has attained considerable growth, may kill it.

"What form of potash should be used in home-made fertilizers?"

The answers to this question must depend somewhat upon the crop to which the fertilizer is to be applied; it has been clearly proven that muriate of potash produces an injurious effect upon tobacco, injuring its burning properties and lessening its market value; it also appears to have been proven that muriate is not as beneficial to potatoes as the sulphate, and that, while the yield is not materially affected, the quality of the crop is injured; it has been shown in Michigan that peach trees fertilized with the muriate form are much more free from diseases, and particularly from the "yellows," where the sulphate is used; the indications are that for corn,

wheat and other grains there is but little, if any difference in the effect of the two grades of potash salts, and that for these crops the main point at issue is cost per pound of the actual potash.

Taking practical experiments as a basis, we would then say that except for peach and other fruit trees, the sulphate is probably best, and that the muriate should be avoided for the tobacco crop entirely.

"What is the best plan to obtain a stand of pasture upon sods that have 'run out' and cannot be plowed?"

In order to properly answer this question it will be necessary to know just why the pasture has "run out." In most cases the so-called running out is due to exhaustion of the soil elements of fertility and when this is the case the application of manure or fertilizers will usually remedy the difficulty; the application of fifty bushels of air slacked lime per acre will, by utilizing plant food in the soil in an insoluble condition, cause the grass to grow again.

If the bare spots are due to the presence of the white grub or other insect pest, it is stated that a good application of common salt will have a good effect; this, however, is doubtful, as, if enough is applied to in any way affect the grub, all vegetation will be destroyed.

I have had good results in reseeding bare spots in meadows by raking the soil that was loose, sowing grass seed and applying a light coat of fertilizer. This may be done to an advantage in clover and timothy mowing fields.

"Will it pay to grow rye for the purpose of turning it under while green?"

It will probably not pay by the mere addition of fertility to the soil, because the rye obtains its soil food mainly from the surface or upper soil, and turning it under merely adds to the soil that which the crop took from it during its growth. In this connection Mr. Terry's adage that "bare soils grow poorer, and sheltered ones grow richer," comes in with full force. The rye grown, as is indicated in the question, may not pay for the fertility added to the soil, but it may pay by the shelter which it affords during the winter, and by preventing more or less of the washing which always follows when the soil is bare.

As a rule, deep rooted plants give the best returns when plowed under; they obtain a portion of their nourishment from the sub-soil, below the plow, and when turned under, leave this increased fertility where it is available for the next crop. In this manner, clover, by obtaining much of its soil food from the stratum of soil not

reached by the plow, brings up more or less phosphoric acid, potash and nitrogen, and holding them in its leaves, branches and roots, gives them to the surface soil from which the growing grain crop obtains its soil food.

There is, however, another element of gain which varies with the character of the soil, and that is the mechanical advantage which results in turning under green vegetable matter. This, by its slow decay, loosens the soil, and on stiff clays, may in this manner accomplish much of the benefit usually attributed to its manurial value.

"When fertilizers are applied in large amounts, is it not possible that a portion of the plant food is lost by being washed out of the soil?"

The loss from this source would greatly depend upon the condition of the special plant food under test; if it was nitrogen, the loss would greatly depend upon its form; if it was applied as a nitrate, which is one of the most soluble forms, and large amounts were used, no doubt a considerable portion would be lost before a long season crop, like wheat, would utilize it; if, on the other hand, it was in the form of dried blood or some of the most insoluble forms, less would be lost, and if in the form of ground leather scrap, probably little, if any, would be lost.

The loss of fertility is greatest with nitrogenous materials, and least with those containing phosphoric acid. Loss of phosphoric acid is prevented by the fact that the "soluble," which is readily dissolved in water, does not exist in the soil except for a very short period of time, too short in fact to admit of loss until the form has been changed. The "soluble" soon takes up another portion of lime and takes on the "reverted" form, in which it is not nearly so soluble, being only taken up through the medium of other chemical constituents in the soil by the plant roots.

If phosphoric acid is applied in the "insoluble" form, the loss is very slight, indeed, and the material will probably remain in the soil until slowly appropriated by the roots of the plants. Crude ground South Carolina or Florida Rock may remain in the soil for years without producing any appreciable effect, and when an effect is produced, the probability is that it is due, not to the use of the material as direct plant food, but to its influence and effect upon other plant food already in the soil.

In the form of ground bone there is but a slight loss of either the nitrogen or phosphoric acid, as both are in a sparingly soluble form, and, consequently, this fertilizer may be more safely applied in large amounts.

"What causes the difference in fertilizing value in the different brands of South Carolina Rock?"

The value of the Dissolved South Carolina Rock depends upon the amount of its phosphoric acid which has been made available as plant food. The phosphoric acid in the original rock is in a form or combination in which it is very slowly available as plant food. The manufacturer adds sulphuric acid, breaks up the old combination, and forms others which are much more readily available.

In the fertilizer trade we find four grades or combinations of phosphoric acid, all of which have a different value. Three of these are found in our South Carolina Rock fertilizers, and its value for plant food depends upon the comparative amounts of the different forms, it being most available as the more soluble form predominates.

If the manufacturer adds sulphuric acid to the crude rock, the old form of four parts of lime to one of phosphoric acid is broken up and two others formed, one of which (soluble) is composed of one of lime and one of phosphoric acid, and the other two of lime and one of the acid. The third is in its unchanged form, not having been acted upon by the sulphuric acid, and is composed of three of lime and one of phosphoric acid.

In the different materials which furnish us with phosphoric acid, we find a great difference in their ability to furnish it in a condition fit for plant food. Ground bone and crude South Carolina Rock both have the phosphoric acid tied up with three parts of lime, but in the former, the combination is much more readily broken up and made available as plant food, and as a natural consequence, the efforts to make use of the crude ground rock as a fertilizer have not yet been profitable, it being more profitable at present prices to purchase some of the more reliable forms.

In reality, we have four forms of phosphoric acid now on the market, viz:

Soluble, one part of lime to one of acid; reverted, two parts of lime to one of phosphoric acid; insoluble, three parts of lime and one of acid, and a fourth (slag phosphate) which has four of lime to one of phosphoric acid. All yield phosphoric acid to the crop in different degrees of rapidity, and are valuable in proportion to the readiness with which they yield available plant food.

"What is the difference between the various forms of potash as found in the market?"

Potash is not found in a free state naturally, but is always in combination with some other element; when in combination with chlorine,

we have the chloride or muriate of potash; when in combination with sulphuric acid we have the sulphate of potash, well known to the trade, and which exists in large amounts in different portions of Europe; and if in combination with nitric acid, we have the nitrate of potash. All of these forms are valuable in fertilizers, but some of them appear to have better effects with certain crops than others, but, for the average crop, their selection is largely a question of the price per pound of the potash which may be obtained from them.

Under some circumstances the most economical form of potash is that from kainit, or German potash salts. It is, however, possible, where freight and handling are competing integers in fixing the cost, that some of the higher brands of commercial salts of potash may be found most economical for use.

The difference in their action is often caused by the fact that, independent of their direct action as plant food, they exercise more or less effect upon the other soil elements of plant food. Thus, they are supposed to more or less act upon and liberate latent phosphate compounds in the soil, and, hence, if applied to one soil rich in these compounds and to another poor in them, different effects will be noted. Another cause, if a difference in effect, is that they may be and sometimes undoubtedly are applied to soil which already contains a sufficient amount of potash in an available form for the wants of the crop; in such cases their effect would of course be negative, and possibly very different from that which follows the application to other soils not rich in potash compounds.

The fact is that all potash salts, and practically all fertilizing articles, have two modes of action; if both of these are exercised, it is but reasonable to suppose that the effect will be greater than if but one mode of action is brought into play; if the application acts as a direct fertilizer by furnishing the crop with needed potash and, in addition, releases phosphoric acid for plant food, the effect is double that produced upon an adjacent soil already rich in potash, and on which the effect is that of action upon other compounds alone.

"In his address, Secretary Edge alluded to buying fertilizers by the unit; what is meant by this term?"

When one manufacturer buys fertilizing supplies from another, he buys by the "unit" or per cent.; the two terms mean the same. If any salt yielding ammonia is stated to contain four per cent. of ammonia, it contains four "units," and if bought or sold by a manufacturer of fertilizers, would be sold and quoted at a certain price per unit. Thus, if ammonia is worth $3.00 per unit in the market, an article containing three per cent. would be worth $9.00 per ton;

if it contained six per cent. its market value would be $18.00, and in a similar proportion as the percentage of the desired ingredient increased or decreased.

The same rule may be as well applied to phosphoric acid and potash as to ammonia or nitrogen, and manufacturers buy their Dissolved or Acidulated South Carolina Rock at a fixed price per unit (per cent.) for the available phosphoric acid which it contains. In like manner, kainit is rated at a price per ton entirely governed by the number of units of potash which it contains.

Following this rule, it is easy to estimate the value per ton of any chemical when the per cent. or unit of the special portion wanted, is known, or the price per unit and the amount per ton being known, it is but a simple problem in arithmetic to calculate the cost of the nitrogen, available phosphoric acid or potash per pound.

For the purpose of expediting such calculations, the Connecticut Experiment Station has prepared the following tables, which show the rule as applied to nitrogen, showing its cost per pound, the cost of Sulphate of Ammonia and Nitrate of Soda being known.

Commercial Sulphate of Ammonia contains on the average 20.5 per cent. of nitrogen, though it varies considerably in quality. With that per cent. of nitrogen (equivalent to 24.3 per cent. of ammonia),

At 3 cents per pound.	Nitrogen costs 14.6 cents per pound.
At 4 cents per pound.	Nitrogen costs 19.5 cents per pound.
At $3\frac{7}{8}$ cents per pound.	Nitrogen costs 18.9 cents per pound.
At $3\frac{3}{4}$ cents per pound.	Nitrogen costs 18.3 cents per pound.
At $3\frac{5}{8}$ cents per pound.	Nitrogen costs 17.6 cents per pound.
At $3\frac{1}{2}$ cents per pound.	Nitrogen costs 17.0 cents per pound.
At $3\frac{3}{8}$ cents per pound.	Nitrogen costs 16.4 cents per pound.
At $3\frac{1}{4}$ cents per pound.	Nitrogen costs 15.8 cents per pound.
At $3\frac{1}{8}$ cents per pound.	Nitrogen costs 15.2 cents per pound.
At $2\frac{7}{8}$ cents per pound.	Nitrogen costs 14.0 cents per pound.
At $2\frac{3}{4}$ cents per pound.	Nitrogen costs 13.4 cents per pound.

Commercial Nitrate of Soda averages 95 per cent. of the pure salt, or 16.0 per cent. of nitrogen.

If quoted at 3.0 cents per pound. Nitrogen costs 18.8 cents per pound.

If quoted at 2.9 cents per pound. Nitrogen costs 18.2 cents per pound.

If quoted at 2.8 cents per pound. Nitrogen costs 17.5 cents per pound.

If quoted at 2.7 cents per pound. Nitrogen costs 16.9 cents per pound.

If quoted at 2.6 cents per pound. Nitrogen costs 16.2 cents per pound.

If quoted at 2.5 cents per pound. Nitrogen costs 15.6 cents per pound.

If quoted at 2.4 cents per pound. Nitrogen costs 15.0 cents per pound.

If quoted at 2.3 cents per pound. Nitrogen costs 14.4 cents per pound.

If quoted at 2.2 cents per pound. Nitrogen costs 13.8 cents per pound.

If quoted at 2.1 cents per pound. Nitrogen costs 13.2 cents per pound.

If quoted at 2.0 cents per pound. Nitrogen costs 12.5 cents per pound.

If quoted at 1.9 cents per pound. Nitrogen costs 11.9 cents per pound.

If quoted at 1.8 cents per pound. Nitrogen costs 11.3 cents per pound.

If quoted at 1.7 cents per pound. Nitrogen costs 10.6 cents per pound.

As it is in many cases desirable to reduce the price of nitrogen to that of ammonia, or to reverse this process, the station furnishes the following table by which the reduction can be easily made:

Ammonia at $3.00 per unit is equivalent to nitrogen at 18.2 cents per pound.

Ammonia at $2.90 per unit is equivalent to nitrogen at 17.6 cents per pound.

Ammonia at $2.80 per unit is equivalent to nitrogen at 17.0 cents per pound.

Ammonia at $2.70 per unit is equivalent to nitrogen at 16.4 cents per pound.

Ammonia at $2.60 per unit is equivalent to nitrogen at 15.8 cents per pound.

Ammonia at $2.50 per unit is equivalent to nitrogen at 15.2 cents per pound.

Ammonia at $2.40 per unit is equivalent to nitrogen at 14.6 cents per pound.

Ammonia at $2.30 per unit is equivalent to nitrogen at 14.0 cents per pound.

Ammonia at $2.20 per unit is equivalent to nitrogen at 13.4 cents per pound.

Ammonia at $2.10 per unit is equivalent to nitrogen at 12.8 cents per pound.

Ammonia at $2.00 per unit is equivalent to nitrogen at 12.2 cents per pound.

Ammonia at $1.90 per unit is equivalent to nitrogen at 11.6 cents per pound.

Ammonia at $1.80 per unit is equivalent to nitrogen at 11.0 cents per pound.

"Is there any violation of law where a club of farmers purchase fertilizer supplies, and employ one of their number to mix them for the club?"

The Department of Agriculture has never in any manner, opposed such modes of obtaining fertilizers, nor has the Attorney General even given the Secretary an opinion upon the point involved in this question. It is quite possible that the legal answer might turn upon the question as to whether the agent thus employed was paid anything for the work of mixing the fertilizer. It is not at all likely that this question will ever seriously arise, but the attention of the Department has been called to it by the manufacturers, and they have made the claim that within the meaning of our law, the agent who does the mixing is, for the time being, a manufacturer of fertilizers, and, therefore, subject to the provisions of our fertilizer act.

If this agent who is employed to do the mixing receives a consideration for his work, it may be claimed that he is in precisely the condition that he would have been had he charged a fixed price per ton, or that he would have been had he purchased the materials according to order and delivered the mixed goods to those who wanted them.

The violation of the fertilizer law is not in the manufacture, but it is in the sale or offer to sell, and if this agent makes neither a sale nor an offer to sell, it is difficult to see how the law can possibly be construed so as to in any manner affect him or his transactions.

It is, however, very easy to see how and where this distinction may be lost and he be brought under the provisions of the act alluded to. It is claimed by some that if he makes a fixed charge per ton, either for the purchase of the materials or for the mixing, he becomes de facto a manufacturer and as such is liable under the law. There is, however, no desire upon the part of the Department to in any manner interfere with farmers who wish to mix their own fertilizers according to their own formulas, but it has several times directed the attention of such to the possible difference which exists between a mixture and a compound.

"What is the comparative value of the different forms of nitrogen made use of by manufacturers of fertilizers?"

The comparative value of nitrogen from the different combinations which usually enter into commercial fertilizers depend so much upon

the soil and crop that the question becomes a very difficult one to answer. The question can probably best be answered by the following table condensed from Wagner, which, taking the action of Chili saltpetre as 100, ranges the other sources after it in the following order and relative value:

Nitrogen in Chili saltpetre,	100
Nitrogen in sulphate of ammonia,	90
Nitrogen in blood and green plants,	70
Nitrogen in fine bone, ground fish, etc.,	60
Nitrogen in stable manure,	45
Nitrogen in fine ground wool,	30
Nitrogen in fine ground leather scraps,	20

Dr. Lindsay, in reviewing the results of German experiments with nitrogen, draws the following conclusions:

"The grains in the following order, viz: barley, wheat, rye and oats have the greatest need of soluble nitrogen, such as nitrate of soda and sulphate of ammonia, because of their short growing period, while roots, late potatoes and grasses, having a longer growing period, can use the slower, lasting forms of nitrogen, such as stable manure, tankage, bone, etc., to better advantage.

"In order that the plant may use costly nitrogen to advantage, it must be well supplied with potash and phosphoric acid.

"Warm, porous soils, rich in lime, favor the most rapid nitrification of ammonia compounds. When the soil is lacking in lime, sulphate of ammonia works poorly as a soil fertilizer. Its action can be greatly improved by liming the soil. The lime neutralizes the sulphuric acid, set free by the process of nitrification, and thus prevents an acid soil. It is well known that bacteria, as a rule, will not work when free acid is present."

"Which is the most profitable source of phosphoric acid, ground bone or South Carolina Rock?"

If both are acidulated or treated with acid, the only difference in value will be the probable difference in market price. South Carolina Rock furnishes the most economical source of available phosphoric acid known, it having been sold to farmers at prices which made the available phosphoric acid cost but little more than three and one-third cents per pound.

Usually, when the two sources are compared, the dissolved rock is compared with the ground raw bone; in this case it must be remembered that the phosphoric acid in the bone is in the form or combination known as "insoluble," while that of the South Carolina Rock is in

the form known as "available," and, hence, the two cannot be fairly compared. The phosphoric acid in the rock is at once available as plant food, while that of the ground bone becomes available much more slowly; the one has had its combination with lime so changed that it has become soluble either in water or in or by the solvents usually met with in the soil; the other has its combination unchanged and cannot rapidly become available plant food until the change is effected through the medium of soil solvents.

The total or general effect of the two will probably not vary greatly, except that the bone will require a much longer time to make its action visible.

In estimating the value of ground bone and in comparing it with other fertilizing materials, it should be remembered that in addition to its phosphoric acid, it also furnishes more or less nitrogen to the crop, and that it should be entitled to a credit for this element; thus, if a ton of ground bone cost twenty dollars and yields four per cent. of ammonia, the amount of seven dollars and twenty cents should be deducted from the price of the bone in order to obtain the actual cost of the phosphoric acid remaining. If, in such case, the nitrogen was not needed, then the ground bone has not proven an economical source of phosphoric acid or of plant food, for an amount equal to eight and one-half dollars per ton has practically been thrown away.

"When Secretary Edge speaks of a certain fertilizer as guaranteed to contain a certain percentage of nitrogen, does he mean that nitrogen actually exists in the fertilizer?"

When a manufacturer guarantees a certain percentage of nitrogen, he means that it contains nitrogen which, if free from any combination, would equal the percentage given; it, however, does not exist in the fertilizer as nitrogen at all. This is best explained by the following by Dr. Collier:

"Nitrogen is a gas, and in that form cannot be used in fertilizers. Therefore, whenever we speak of nitrogen in fertilizers, we do not mean that nitrogen exists in them as a simple nitrogen. As previously stated, the nitrogen in fertilizers is always combined with other elements and may be present in one or more different forms; first, in the form of nitrates as in nitrate of soda; second, in the form of ammonia compounds, such as sulphate of ammonia, and, third, in the form of organic matter such as animal or vegetable, as dried blood, meat, tobacco stems, etc. Chemical analyses, according to official methods do not attempt to ascertain and state in which form or forms the nitrogen exists in a fertilizer. Therefore, the numbers in the columns under "determined as nitrogen" are intended to state

simply the amount of nitrogen present, without regard to the form in which it is present or, expressed in another way, how much nitrogen there would be if it were present in the form of pure nitrogen or nitrogen gas."

"What does Secretary Edge mean by 'indirect' fertilizer?"

Fertilizers are sometimes divided into two classes, "direct" and "indirect." A "direct" fertilizer is one which supplies plant food directly to the crop and has but little if any effect beyond the action, as plant food, of the material which it contains; of this class we may instance ground bone, sulphate of potash and nitrate of soda.

An "indirect" fertilizer is one which produces action other than as a direct plant food, which influences materials already in the soil and fits it for plant food. This class is represented by lime, salt and similar materials.

In some cases the application of an "indirect" fertilizer is equivalent to the application of a direct one of entirely a different character. Thus, upon some soils, the application of lime is equivalent to a dressing of potash, because the soil contains a salt of potash in a form not soluble or useful as plant food; the lime breaks up the combination, releases the potash and, at least in some cases, forms new combinations which are often valuable and are "direct" fertilizers, though produced through the agency of an "indirect" one.

The effect of "indirect" fertilizers may be illustrated by a mixture of lime and salt. If the materials are finely divided and well mixed together, two new compounds will, in course of time, be formed, both formed by an interchange of elements in the two original articles used. The alkali (lime and soda) change bases and form new forms of plant food.

It is claimed that the results which follow the application of common salt are those of an "indirect" fertilizer, the salt acting upon materials already in the soil, breaking up combinations and forming new and more valuable ones.

In its effects upon humus and decaying vegetable matter in the soil, lime affords an excellent illustration of an indirect fertilizer. The benefits derived from this application cannot be ascribed to the direct action of lime as a plant food, and can only be attributed to its action in forming new compounds and releasing otherwise insoluble matter in the soil.

"Does the use of commercial fertilizers pay?"

Taking the data for the answer from our own observations, we might readily answer it either in the affirmative or the negative, but

will give the following affirmative answer by D. C. Lewis, of Cranberry, New Jersey.

Previous to the application of the fertilizers or the commencement of the experiment, the 18-acre field had the following treatment:

In July, 1893, it was covered by 144 loads of manure, or at the rate of 8 loads per acre; in 1894, it was plowed for corn and 200 pounds of corn fertilizer per acre drilled in with the seed. The yield was 45 bushels per acre and the value of the corn and fodder was estimated at $24.55 per acre, or a total value of $441.90 for the whole field.

From this point, following Mr. Lewis' account, we have the following:

"In 1895 the corn stubble was plowed and the field was planted to potatoes, using 1,000 pounds of fertilizer per acre. The yield was over 5,000 bushels, which sold at a very low price. Including the estimated value of the small potatoes fed to the stock, the crop brought $1,102, while the cost of the fertilizer was $473.40.

"As soon as the potatoes were dug, the field was worked up and sown to wheat, with 400 pounds of fertilizer per acre. The wheat gave 34 bushels per acre and sold at 73 cents per bushel. This gave an income of $446.76 for the wheat, while the fertilizer cost $136.80.

"In 1897, this field is in grass, and has given not less than $2\frac{3}{4}$ tons of hay per acre, which, at $8 per ton, represents $396. The second cutting of the grass, in 1898, will give at least two tons per acre, which, at the average price of $10 per ton, will bring $360. All this gives us the following statement:

	Income.	Cost of Fertilizers.
1894. Corn crop, ...	$441 90	$72 00
1895. Potato crop, ...	1,102 00	473 40
1896. Wheat crop, ...	446 76	136 80
1897. Hay crop, ...	396 00	.....
1898. Hay crop, ...	360 00	.....
Total, ...	$2,746 66	$682 20

"In other words, during the five years' rotation, the cost of fertiliing for this 18-acre field averaged $136.40, or $7.58 per acre for each year. The sales from the field averaged $549.33, or $30.52 per acre for each year. This leaves an average margin of $22.94 per acre to pay for seeding, labor, interest and other expenses through the whole rotation.

"We take the five different crops in this way since, under this system, it is hardly fair to figure any single one. The fertilizer for the potato crop cost $473.40, or $26.30 per acre. yet by rights that should be divided by three, since it has also produced two crops of grain. This year's expense in the hay field will be but the cost of cutting and

handling, yet it would not be fair to say that the hay cost nothing for fertilizer. In a rotation of this sort one crop works into another and helps it out, so that it is difficult to figure on the cost of any one crop."

"Is the analysis, as branded upon fertilizer sacks, found to be generally reliable?"

During the past year over 1,400 samples of commercial fertilizers were selected by the special agents of the Department and sent in for an official analyses. The result clearly shows the benefit of the law as to the average sample, but no attempt was made to ascertain how many were below the guaranteed analysis. We may, however, take the results of similar analyses at the Hatch Experiment Station, in Massachusetts, as a criterion. These, when tabulated, show the following results:

1. Complete fertilizers, or those containing three ingredients, nitrogen, potash and phosphoric acid:

With elements equal to or above highest guarantee,	3
With two elements above highest guarantee, ...	18
With one element above highest guarantee, ...	65
With three elements between highest and lowest guarantee, ...	26
With two elements between highest and lowest guarantee, ...	60
With one element between highest and lowest guarantee, ...	42
With two elements below lowest guarantee, ...	8
With one element below lowest guarantee, ...	59

In our experience in this State we usually find that where one or two elements fall below the other, one or two are found to be above the guarantee, but this is not always the case.

2. Fertilizers containing but two elements as, for instance, ground bone, phosphoric acid and nitrogen, or alkaline fertilizers with potash and phosphoric acid:

With two elements above highest guarantee, ...	3
With one element above highest guarantee, ...	16
With two elements between highest and lowest guarantee, ...	13
With one element below the lowest guarantee, ..	10

3. Fertilizers with but one element, as South Carolina Rock:

Above highest guarantee, ...	4
Between highest and lowest guarantee, ...	21
Below lowest guarantee, ...	11

In this connection it should be remembered that the lowest figure of the analysis is all that is really guaranteed to the purchasers.

"What is the fertilizer known as 'Thomas slag' and how and from what is it made?"

"Thomas slag" is made by grinding up the linings of the converters in which basic steel is made; these converters are lined with limestone which absorbs the phosphorous, and retains it in connection with the lime formed at the same time by the burning limestone. This material is ground into a fine powder, and constitutes without treating it with acid, the fertilizer alluded to.

Opinions differ as to its value as compared with dissolved South Carolina Rock or bone, but, chemically its phosphoric acid is in a comparatively insoluble form and probably not as readily assimilated by the plants as some of the other forms found in the fertilizer markets.

"What is the meaning of the words 'total phosphoric acid,' as placed upon bags of Acidulated South Carolina Rock?"

The only reason that can probably be given for their use is that manufacturers find that a certain class of purchasers prefer these brands which have a large amount of lettering upon the bags, and thus endeavor to satisfy the purchaser.

Practically there is need for but one line upon the analysis of Acidulated South Carolina Rock. If the manufacturer would brand the "available phosphoric acid" it would answer every purpose and be less confusing to the average purchaser. The only objection to this is that the law requires that both "soluble" and "reverted" phosphoric acid shall be placed upon the sacks. These two added together make the "available," but under our system of valuation, have different prices per pound. Some manufacturers appear to try to confuse the purchaser by adding much to the brand that is useless. Thus, we often find the following upon bags of this class of fertilizers:

Soluble phosphoric acid,	8 to 9.
Reverted phosphoric acid,	3 to 4.
Insoluble phosphoric acid,	2 to 3.
Total phosphoric acid,	13 to 16.
Bone phosphate of lime,	24 to 28.

By adding the "soluble" and "reverted" phosphoric acid of the above analysis together, we have "available"phosphoric acid, 11 to 13, and this is all that the purchaser cares anything about, and, practically all that is of value which he obtains in his purchase. The "insoluble" phosphoric acid is of comparatively no value; the "total" phosphoric acid is obtained by adding the other three kinds together, and, hence, is but a repetition, and the "bone phosphate of lime" is in another form, but a repetition of the "total" phosphoric acid. Hence, the words "available phosphoric acid, 11 to 13," are all that are really necessary as a guide to the buyer and all else is but liable to confuse him and lead him astray, the object being, of course, to increase the apparent value of the fertilizer in the estimation of those not well versed in analyses.

"Are unleached wood ashes a profitable form of potash to be used for mixing with fertilizers?"

It is not safe to mix unleached wood ashes with any fertilizing material which contains nitrogen; the potash of the ashes is in such a form that it will release the nitrogen and cause it to be lost unless some excellent absorbent is present. Unleached ashes when mixed with bone has the same effect, and, if the proper value is placed upon the nitrogen, will do more harm than good.

If mixed with chicken manure, as is sometimes done, the effect is even worse and the loss greater, the nitrogen, which is the most valuable element in the manure, being given off and lost. Better apply each material separately, and let them become mixed in the soil where the latter will act as an absorbent and save all loss.

"How does land plaster act as a fertilizer?"

With chemical analysis as the basis of our theory, we must infer that the benefit derived from an application of land-plaster or gypsum must come from some chemical action, as it contains nothing but lime and sulphuric acid, neither of which are especially beneficial to vegetation.

Its main use and benefit is as an absorbent on manure piles and in the stables and poultry house; its power, in connection with moisture, to fix nitrogen, gives it a great value for the above purposes, and it should always be kept at a convenient place in the stables and poultry houses.

"Does manure lose by laying on the surface after it has been spread?"

Not unless there is a loss from washing off the field; the elements which are lost are not those of value, and it has been found by careful experiment that the loss by evaporation is practically null. If however, the field is so situated that rain water runs rapidly off, or if the melting snow finds its way directly into a public road or stream, loss may ensue. Each one must be his own judge of such matters, and no definite rule to cover all cases can possibly be laid down.

If we compare the loss by the manure remaining in the unsheltered yard all summer with that by evaporation, it will not require much argument to settle the question in favor of hauling it out and spreading as fast as it is made.

"Can muriate of potash be economically used without being mixed with other chemicals or materials?"

Muriate of potash adds nothing to the soil but potash, and if it can be bought at proper prices, it is probably, when freight is taken into consideration, a cheap source of this element which is necessary to the growth of all farm crops. Careful experiments have shown that for potatoes it is best to use the sulphate, and for peach and other fruit trees, the muriate. Experiments show that potatoes grown with the muriate are better in quality and in yield with the same number of pounds of actual potash.

In very many cases it will be found most economical to apply it mixed with Dissolved South Carolina Rock, as most soils are benefited by the application of phosphoric acid and potash, and many do not respond to the application of nitrogen.

"Has not the farming community, at least to a certain extent, been impoverished by the unintelligent use of commercial fertilizers?"

There is no doubt but that a large amount of money is annually lost by a careless use of fertilizers. High priced complete fertilizers

have been used when an equal amount of Dissolved South Carolina Rock, costing probably one-third as much, would have produced as good results. Complete manures have been used when those composed of South Carolina Rock and potash, and costing about half as much, would have given as good results. In many cases farmers have paid fifteen cents per pound for nitrogen when they already had too much in their soil for the needs of the crops, and the surplus was not only a loss, but also a positive disadvantage, in effect decreasing instead of increasing the crop.

"What amount of lime should be applied at one time?"

Smaller applications repeated at shorter intervals will no doubt pay best; twenty-five bushels applied twice in the rotation of eight years will undoubtedly give better results than fifty bushels applied at the end of the rotation. It soon loses its greatest power of action and hence gives the best results in amounts of about twenty-five bushels per acre.

It should be applied at that period of the rotation at which vegetable matter is most abundant; in the usual rotation followed in this State this is either when the sod is turned under for corn or on the wheat stubbles after wheat harvest. Apply when in its most finely divided state and spread evenly.

"What is the best plan for enriching land which is too poor to produce corn or wheat?"

The first thing is to get it into condition to hold a crop of clover; this may be done in a variety of ways; fertilizers may be bought and applied; if the location is favorable, manure may be purchased and applied; grain may be purchased and fed on the farm and the resulting manure carefully applied to the land; if it contains any vegetable matter lime may be applied or if its insoluble plant food is easily made available, it may be unlocked by the application of lime.

In such cases it is usually safe to assume that any great increase of fertility can only come through the purchase of plant food from some source outside the farm, and the selection of the most economical source will depend altogether upon location and surroundings, and no rule can be given which will fit any two cases.

Usually such land lacks vegetable matter and as soon as this can be obtained in the form of any kind of a sod the problem has been largely solved, and if this sod is one of thick clover the problem is three-fourths solved, and the increase in fertility is but a question of time, depending upon the use which is made of the crops of hay produced.

But does it pay to bring up such land? Accepting the theory that no fertility can be added except through direct or indirect purchase, it is quite possible that in many instances the cost of the fertility exceeds the increased value of the land.

Many hold the theory that it is more economical to buy land in good condition rather than to bring it up when poor.

"Is sub-soiling profitable?"

Experiments at the Pennsylvania Experiment Station do not show enough of benefit to pay for the additional expense, and it is quite probable that with our cheap land it is more profitable to increase the acreage, rather than use sub-soil plows. The station experiments seem to indicate that the use of a separate sub-soil plow nearly doubles the cost of plowing. In other experiments it has been shown that, even taking a number of years into consideration, the increased crop will not pay the increased cost of the work.

"Which is the best fertilizer for potatoes, muriate or sulphate of potash?"

We have no record of experiments in our own State which will enable us to answer this question, but the Hatch experiment station report gives the following conclusions after extended experiments with the two chemicals on the potato crop:

"1. Eight experiments, comparing sulphate with the muriate of potash, have given an average of 22.1 bushels of merchantable tubers per acre more where the sulphate was the source of potash.

"2. The eating quality of the tubers raised when the sulphate has been the source of potash has generally been better than when the muriate was used.

"3. Analyses have generally shown that the tubers raised on the sulphate have contained less water and more starch than those raised on the muriate. When this has not been the case, it is believed to have been because the tubers had not properly ripened, owing to the premature death of the tops on account of blight.

"4. There has been little difference in the appearance of the tubers raised on the two fertilizers, but the advantage is slightly with the muriate.

"5 The number of bushels per acre in favor of the sulphate has ranged from 4.8 to 82.5 of merchantable tubers. On only one out of the eight experiments has the muriate excelled the sulphate; the difference was then only 28 pounds per acre.

"6. The fertilizer in the drill has generally given larger crops than broadcast. This has been the case in six out of eight experiments, the range being from 12.5 bushels to 54 bushels of merchantable tubers per acre in favor of the drill application."

In referring to the quality of the crop, the same report (page 23) has the following:

"In each year, soon after digging, the samples of potatoes grown respectively on sulphate and muriate of potash have been sent under numbers with no other information to several families, who were requested to use them and report whether there was any difference in quality. In 1892 all reported that the potatoes grown on the sulphate were whiter, more mealy, and better flavored than the others. In 1893 they all reported that they could see no differeuce betweeen them. In 1894 and 1895 the potatoes grown upon the sulphate were with one or two exceptions, reported to be superior to those grown in the muriate, in color, mealiness and flavor. Those reporting otherwise could see no great difference. In 1894 the head of one family said "If you have potatoes like No. 1 (grown on sulphate) I would like to get my winter's supply of you, but I would not take No. 2." The season of 1893 was exceptionally hot and dry, as was also that of 1894; but the soil used in 1894 was deeper and the crop suffered comparatively little from drought."

Prof. Brooks of Amherst, in referring to the same question, writes: "Experiments which have beeen repeated many times on different soils and extending through five years have convinced me that this form (sulphate) is much superior to the muriate, giving larger yields, of better quality. Suffice it to say that the yield where sulphate has been used has beeen far more than enough to cover the highest cost of the former. I wish to make emphatic the expression of my belief that all potato fertilizers should contain sulphate and not muriate as the source of potash."

"We have been using Dissolved South Carolina Rock for mixing with potash and soda salts; in some cases the mixture was so stieky that we have been compelled to use Dissolved Bone Black instead, but this has gone up in price from seventy-five cents to one dollar per unit; which is the best?"

In all probability the stickiness was due to the form of and quantity of potash made use of; if the mixture yields more than four per cent. of potash and the South Carolina rock was not quite dry, stickiness will be troublesome. The form of potash used may also have more or less influence upon the result.

Your statement that by buying the ingredients near home you can

save three dollars per ton in freight, opens up the whole question of home-mixed fertilizers, and renders the two transactions subject to the conclusion that you either are getting a lower grade of rock and of potash or else the dealer, by purchasing in large amounts can save in freight; in all such cases the purchaser should demand the same guarantee for each ingredient that he does for the mixture from the factory; in some cases which have come under our notice this has not been the case, for while the mixed compound was purchased under a written guarantee as to available phosphoric acid and potash, the unmixed materials were bought upon the statement of the local dealer and without any guarantee of any kind.

Dissolved South Carolina rock undoubtedly furnishes the cheapest source of available phosphoric acid now on the market, and hence its use has been recommended. Bone would undoubtedly make a dryer mixture, but its phosphoric acid is not in what is known to the trade as "available" form; it, however, eventually all becomes available as plant food.

Properly dried South Carolina Rock should admit of the mixture of a reasonable amount of potash or soda salts without the mixture becoming so sticky as to interfere with its proper and convenient use; if the mixture is a home-made one this may, of course, be avoided by the use of common plaster or gypsum, but from the fact that the acidulated South Carolina Rock contains, from reversion and chemical action, a large amount of gypsum, this will not produce its proper effect on the crop.

Dissolved bone black differs from dissolved animal bone, from the fact that it has been burned and the ammonia driven off and saved in the form of ammonia salts; the burnt bone, freed from its nitrogen, is used in sugar refineries to remove certain impurities from the sugar, and to the extent to which it contains these impurities, has lost value as a fertilizer.

The selection of the source of phosphoric acid (available) is governed, other things being equal, by the cost per unit of its available phosphoric acid and not by its price per ton. South Carolina Rock may be furnished at almost any price above seven or eight dollars per ton, but its price is usually in proportion to the amount of available phosphoric acid it contains, and it is a rule that, if freights are taken into consideration, the higher grades furnish the phosphoric acid at the lowest price per unit.

"What is the most economical commercial fertilizer for the corn crop?"

Corn has been styled the hog of crops, and it can probably better utilize any fertilizer which may be applied than any other crop in

the usual rotation. According to the Amherst (Mass.) station, the following is the result of their experience after a number of very careful experiments:

1. It is usually not necessary to supply a large amount of available nitrogen for the corn crop, and this is explained by the fact that, growing as it does chiefly after considerable warm weather, it can depend largely upon the nitrogen of the organic matter of the soil which becomes available under the influence of natural agencies during the summer.

2. The corn crop does not make a heavy draft upon the phosphoric acid of the soil, and it is not economy to apply this element largely.

3. The yield of both grain and stover is largely dependent upon the supply of potash. This should be prominent in a fertilizer for this crop; and, even if nothing else is employed with manure, it will generally be found profitable to use some muriate of potash.

The station reports the following as the fertilizer which has given them the best results for corn, and it will be noted that its composition both as to phosphoric acid and nitrogen, contradicts the axioms quoted:

Nitrate of soda (pounds),	125
Dried blood (pounds),	200
Dried fish scrap (pounds),	200
Cotton-seed meal (pounds),	200
Plain superphosphate (pounds),	200
Floats (ground Florida Rock) (pounds),	100
Muriate of potash (pounds),	200

"What is the most practical manner of applying stable manure so as to give the best results?"

There is no time in the existence of a load of stable manure when it contains as much fertility as when it first comes from the stable. No matter how well cared for, it will lose more or less of its value after it is taken out of the stable. If spread upon rolling or hilly ground it is claimed that it will lose in value from washing. It then becomes a problem to decide under which train of circumstances it will lose the least, and we think it will be found that the advantages except in special cases, are in favor of spreading as fast as taken from the stable, especially during the winter when the teams can be taken into the fields.

We think that if applied to the sod for corn during the winter it will be found that the corn will not use up more of the fertility of the manure than would have been wasted than if it had been kept in the open yard all summer to be bleached by rain and injured by evaporation.

Experiments at the Cornell experiment station seem to prove that, even under comparatively favorable circumstances, yard manure will lose over one-half of its manurial value by exposure from the middle of April to the end of September. If the loss is this great under comparatively favorable surroundings, what will it be in the average Pennsylvania barn yard?

In special cases and with special crops, this plan is not expedient or possible, but for the average crop the indications are that the loss is least the sooner the manure can be gotten on the land.

"Is an agent who sells commercial fertilizers compelled to take out a license?"

An agent who sells commercial fertilizers may possibly have to take out a mercantile license just as he would for the sale of any other commodity; in some few counties of the State local laws are yet in force which, if taken into court, would compel any manufacturers selling fertilizers in the county to file in the proper county office a copy of his guaranteed analysis, but the rigid enforcement of the State law has practically and without any legislative enactment, repealed all such local laws.

All manufacturers who offer or sell, either by themselves or by agents, fertilizers, must record the guaranteed analysis of each brand with the Department of Agriculture, comply with the requirements of the law relating to the branding of bags, and pay a license fee varying from ten to thirty dollars, depending on the amount of sales during the preceding year, for which they will receive a license authorizing them to sell all licensed brands in the State by any number of agents they may select.

The law makes it the duty of the agent to know that the fertilizers which he sells or offers for sale have been properly licensed and that the bags are branded according to law, and he, with the manufacturer, is liable for a heavy penalty. There is no way in which manufacturers outside of the State can be reached or controlled except hrough the agents who sell the goods in the State, and it is expected that he will hold non-resident manufacturers liable for any penalties or losses which he may suffer.

"What crops will give the best results from an application of barnyard manure?"

The object for which the crop is produced will at all times have some effect upon the answer. Probably no crop will give better

returns in amount of feed than corn or clover. Of all farm crops corn can best utilize green manure which has been turned; the only exception being the following of a dry season by which injury is done from the large amount of vegetable matter turned under which sometimes causes injury instead of benefit.

If a large yield of potatoes is the sole object and quality is not so much of an object, the potato crop will utilize a large amount of yard manure, but the quality will be injured at the expense of quantity.

It is extremely difficult to apply green manure to the clover crop without injury from getting it too thick, smothering the clover out; where the manure is short its application directly to the clover crop during the fall or winter will give good results in hay and forage, but where both grain and fodder are fed on the farm it is doubtful if any crop will give such good results as that of corn.

"Can any one sending samples of fertilizers to the Department of Agriculture have them analyzed and reported upon?"

The work of analyses of commercial fertilizers as performed by the Department of Agriculture, is governed by section 4, of the act of June 28, 1879, afterwards amended by the act of May 21, 1895, which provides as follows: "It shall be the duty of the State Board of Agriculture (now Department of Agriculture) to analyze such specimens of commercial fertilizers as may be furnished by its agents, said samples to be accompanied with proper proof, under oath or affirmation, that they were fairly drawn."

Under the authority given by this section the Department of Agriculture appoints proper agents, and at the proper time of the year when fertilizers are coming into the market, they are sent into all sections of the State and obtain and send to the chemist of the Department samples of such fertilizers as they may find, and the Secretary of the Department selects such as are to be analyzed. Care is taken to obtain samples at least once in three years of all fertilizers sold or offered for sale in the State, and the whole expense of the selection of samples, making analyses, &c., is paid from a special fund formed by the license fees paid in by the manufacturers.

In view of the plain provisions of the law the Department cannot receive and analyze samples sent in by individuals, nor would it be safe to do so, as the selection of proper samples involves considerable skill and practice. If samples were accepted from any who might choose to send them, the Department would be in a continual wrangle with the manufacturers as to the manner in which the sample was drawn.

"What can I afford to pay per ton for wood ashes?"

The value of wood ashes is dependent upon the amount of available potash and phosphoric acid which they contain, as they yield no nitrogen at all. If from hard wood and not leached the analysis should show from four to six per cent. of potash and from one to one and three-quarters of phosphoric acid; the potash is in its most available form and is worth five cents per pound; the phosphoric acid may be valued at about the same rate per pound; if the ashes analyzed four per cent. of potash and one of phosphoric acid, it would be worth, as fertilizers are valued, about five dollars per ton.

The trouble with much of the wood ashes imported from Canada is that much of its potash is in an insoluble condition, caused it is said by the high degree of heat to which the ashes are exposed, which has the effect of vitrifying the potash and rendering it insoluble as plant food. This material, as well as all others used for fertilizing purposes, should always be purchased upon a guarantee as to its potash and phosphoric acid, and any reliable dealer should be willing to supply such a guarantee. In such guarantees the use of the word "available" is very important, for ashes may contain both potash and phosphoric acid in an unavailable and almost useless form; if not guaranteed as "available" it may be of little or no use and may be dear at the freight cost.

"Can fertility be brought to the soil by underdraining?"

Stagnant and surplus water in the soil will prevent plants from using the fertility which may be there. As soon as the water is removed the roots of the plants have access to all soil food which is in a proper condition for the support of plant life, and in this way it may be claimed that draining will bring into the soil, although, strictly speaking, it only enables the crops to obtain the fertility which is already there. Draining deepens the soil, and by this means gives the crop a greater amount of soil upon which to feed and in this manner it also may be claimed that underdraining adds fertility to the soil.

"Will not drained land suffer in dry weather?"

It does not. Draining tends to equalize the amount of water in the soil; if there is too much, it removes the surplus below the roots of the plants and to the bottom of the drain, but during dry weather, water is raised to near the surface by capillary attraction and retained where it can be made use of by the roots of our crops. Drained

land will not suffer in dry weather, nor will it suffer during wet weather, contradictory as it may seem.

"Is chemical analyses sufficiently reliable to admit its results as a comparison between fertilizers?"

The question has been raised during the time which has elapsed since the passage of our fertilizer law, and on several occasions experiments have been carefully made to ascertain the correctness of the results. At the present time, all analyses reported by Dr. Frear are made in duplicate and some of them in triplicate, and if any good causes exist for doubt, another analysis is ordered.

In 1883, an attempt was made to give a definite answer to this question in the following manner:

A carefully selected sample of Acidulated South Carolina Rock was drawn from a large pile, and, in order to secure uniformity in the sample, it was ground in a mortar and carefully divided into six samples, one of which was sent to a leading chemist in the states of Pennsylvania, Connecticut, Massachusetts, Maryland, New Jersey and Delaware; in our own State, a sample was sent to the chemist of the Board. In each case, care was taken to select a chemist noted for his expertness in the special work of the analyses of commercial fertilizers.

Nothing was stated about the particular method to be pursued, and hence, each pursued his own plan in the analysis.

The results of this test, reduced to a water free basis, is as follows, the valuations having been added after all of the analyses were reported, and all, of course, based upon the same data:

	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Total phosphoric acid.	Available phosphoric acid.	Commercial value per ton.
No. 1,	9.11	4.79	2.42	16.32	13.90	$29 01
No. 2,	9.98	1.55	4.81	16.34	11.59	27 02
No. 3,	10.13	2.26	4.00	16.39	12.39	28 09
No. 4,	10.10	3.53	2.89	16.37	13.68	29 53
No. 5,	9.89	4.19	2.25	16.33	14.08	29 68
No. 6,	9.82	4.29	1.89	16.00	14.11	29 46
Average,	9.84	3.41	3.01	16.29	13.28	$28 78

It will be noted that in the results of these analyses, the "total phosphoric acid" is essentially the same, and that the variation is in the "soluble and reverted phosphoric acid," the value of which is practically the same.

At the time there were two methods in use among chemists, and it was found that one method was followed by four of the chemists, and the other by the remaining two.

In order to still further test the matter, a sample was carefully divided between two chemists, known to be making tests by the same method; as a result, they returned 12.10 and 12.34 of available phosphoric acid, respectively, and 16.23 and 16.16 of total phosphoric acid; the commercial values of the respective samples were $27.47 and $27.50.

"When the percentage of nitrogen in a given compound is guaranteed, how can we determine its cost per pound?"

Multiply the percentage of nitrogen in the compound by twenty, and it will give the number of pounds of this element in a ton; divide the price per ton by the number of pounds in a ton, and the result will be the cost of the nitrogen per pound.

To convert the percentage of nitrogen into ammonia, multiply by seventeen and divide by fourteen; to change ammonia into nitrogen multiply by fourteen and divide by seventeen; fourteen pounds of nitrogen united with three of hydrogen will form seventeen of ammonia. Another rule giving the same result is to reduce ammonia to nitrogen by multiplying by the decimal .824; both obtain the result upon the principle stated, that fourteen parts of nitrogen are equivalent to seventeen parts of ammonia.

Nitrogen is usually sold and quoted in trade journals by the unit or per cent.; seven per cent, of nitrogen being a seven units article. In order to ascertain the price or cost of the nitrogen per pound, when the price per unit is given, the following table is valuable, and is taken from the report of the Connecticut Experiment Station:

Ammonia at $3.00 per unit is equivalent to nitrogen at 18.2 cents per pound.

Ammonia at $2.90 per unit is equivalent to nitrogen at 17.6 cents per pound.

Ammonia at $2.80 per unit is equivalent to nitrogen at 17.0 cents per pound.

Ammonia at $2.70 per unit is equivalent to nitrogen at 16.4 cents per pound.

Ammonia at $2.60 per unit is equivalent to nitrogen at 15.8 cents per pound.

Ammonia at $2.50 per unit is equivalent to nitrogen at 15.2 cents per pound.

Ammonia at $2.40 per unit is equivalent to nitrogen at 14.6 cents per pound.

Ammonia at $2.30 per unit is equivalent to nitrogen at 14.0 cents per pound.

Ammonia at $2.20 per unit is equivalent to nitrogen at 13.4 cents per pound.

Ammonia at $2.10 per unit is equivalent to nitrogen at 12.8 cents per pound.

Ammonia at $2.00 per unit is equivalent to nitrogen at 12.2 cents per pound.

Ammonia at $1.90 per unit is equivalent to nitrogen at 11.6 cents per pound.

Ammonia at $1.80 per unit is equivalent to nitrogen at 11.0 cents per pound.

The same report gives the following table which will enable the reader quickly to reduce the price per pound of commercial sulphate of ammonia to the cost per pound of the nitrogen which it furnishes; the table is based upon the supposition that the sulphate of ammonia is commercially pure, and will give 20.5 per cent. of nitrogen, 24.3 per cent. of ammonia:

At 4.00 cents per pound.	Nitrogen costs 19.5 cents per pound.
At 3.95 cents per pound.	Nitrogen costs 19.3 cents per pound.
At 3.90 cents per pound.	Nitrogen costs 19.0 cents per pound.
At 3.85 cents per pound.	Nitrogen costs 18.8 cents per pound.
At 3.80 cents per pound.	Nitrogen costs 18.5 cents per pound.
At 3.75 cents per pound.	Nitrogen costs 18.3 cents per pound.
At 3.70 cents per pound.	Nitrogen costs 18.0 cents per pound.
At 3.65 cents per pound.	Nitrogen costs 17.8 cents per pound.
At 3.60 cents per pound.	Nitrogen costs 17.5 cents per pound.
At 3.55 cents per pound.	Nitrogen costs 17.3 cents per pound.
At 3.50 cents per pound.	Nitrogen costs 17.1 cents per pound.
At 3.45 cents per pound.	Nitrogen costs 16.8 cents per pound.
At 3.40 cents per pound.	Nitrogen costs 16.6 cents per pound.

Nitrate of soda (commercially pure), contains 16 per cent. of nitrogen, and its price per pound may be changed into cost per pound of nitrogen by the following table:

If quoted at 3.0 cents per pound, Nitrogen costs 18.8 cents per pound.

If quoted at 2.9 cents per pound, Nitrogen costs 18.2 cents per pound.

If quoted at 2.8 cents per pound, Nitrogen costs 17.5 cents per pound.

If quoted at 2.7 cents per pound, Nitrogen costs 16.9 cents per pound.

If quoted at 2.5 cents per pound, Nitrogen costs 15.6 cents per pound.

If quoted at 2.4 cents per pound, Nitrogen costs 15.0 cents per pound.

If quoted at 2.3 cents per pound, Nitrogen costs 14.4 cents per pound.

If quoted at 2.2 cents per pound, Nitrogen costs 13.8 cents per pound.

If quoted at 2.1 cents per pound, Nitrogen costs 13.2 cents per pound.

If quoted at 2.0 cents per pound, Nitrogen costs 12.5 cents per pound.

If quoted at 1.9 cents per pound, Nitrogen costs 11.9 cents per pound.

If quoted at 1.8 cents per pound, Nitrogen costs 11.3 cents per pound.

If quoted at 1.7 cents per pound, Nitrogen costs 10.6 cents per pound.

"Why does Dr. Frear, when calculating the 'Comparative Commercial Value' of a fertilizer, give several valuations for nitrogen or ammonia?"

In the 1898 schedule of valuations, several prices per pound are assigned to nitrogen, but the schedule distinctly states that "nitrogen in all mixed fertilizers will be valued as derived from the best sources of organic nitrogen, unless clear evidence to the contrary is obtained." This assigns but one value, fourteen cents per pound, to nitrogen, except in cases in which the analysis clearly shows that some less available and lower grade was made use of.

The valuations assigned by Dr. Frear are as follows:

	Cents per lb.
Nitrogen in ammonia salts,	13½
in nitrates,	14
in dry and fine ground fish, meat and blood, and in mixed fertilizers,	14
in cottonseed meal and castor pomace,	12
in fine bone and tankage,	10
in medium bone and tankage,	9
in coarse bone and tankage,	7

These figures, however, are not to be taken as representing the actual or agricultural value to the farmer, but rather as the comparative cost of the different forms in the open market, the average of the year being taken as a basis.

The value of the crops in a great measure (but not altogether), depends upon the availability of the nitrogen obtained. This is probably best shown by the following table by Wagner, in which the dif-

ferent forms of nitrogen were applied and the results carefully noted; the action produced by nitrate of soda was taken as the measure of all, and placed in the table at 100; the figures opposite each kind of nitrogen represents its availability to the crop, that of nitrate of soda being taken as 100:

	In experiment of the first year.	Average of first and second year's experiment.	Average of first, second and third year's experiment.
Nitrate of soda,	100	100	100
Sulphate of ammonia,	85	74	88
Peruvian guano,	84	88	80
Blood meal,	67	67	69
Castor pomace,	62	65	67
Green crop manure,	62	60	68
Horn meal,	63	61	63
Fish guano,	51	59	64
Steamed bone meal,	42	53	61
Flesh meal,	44	47	54
Wool dust,	27	28	33
Stable manure,	11	16	32
Leather meal,	13	12	20

An experiment at the Connecticut Station warrants the following estimate of the availability of the different sources of nitrogen, nitrate of soda being again taken as the unit of measure, and placed at 100:

Nitrate of soda,	100
Castor pomace (B),	85
Linseed meal,	80
Dried blood,	77
Cotton seed meal,	76
Castor pomace (A),	74
Dry ground fish,	70
Tankage,	68

"In his discussion last evening of the possible formation of nitrogen by red clover, the Secretary alluded to the influence of bacteria in the work. Is this theory generally accepted?"

When first advanced, the theory of the influence of bacteria was very generally accepted without much doubt or discussion, but since our scientists have given more general attention to it, the doubt has

gradually increased, until, in some of our more recent reports, the theory is not only doubted, but even denied. In the Experiment Station Record (Vol. VII, No. 9), Dr. A. C. True, director, thus alludes to the bacteria theory of the production of nitrogen by leguminous plants:

"The author has sought by means of pure cultures, soil investigations, and inoculation experiments to ascertain the probable number of forms of bacteria capable of forming tubercles on the roots of leguminous plants. The methods employed by the author are described very minutely. Plate, gelatin, and potato cultures were made of all forms found in the tubercles of *Lupinus albus*, *L. angustifolius*, and *L. luteus*, and the winter soil was carefully examined to learn how the organism passes the winter. He found in his cultures several forms of *Bacillus* and *Micrococcus*, and claims that those bacteria forming tubercles on the roots of legumes are spore forming, and in this way pass the winter in the soil.

"From his experiments the author thinks that there is not so great a necessity for the presence of bacteria for nitrogen assimilation as is sometimes claimed, and that the relationship between the plant and the organism is often one of parasitism rather than of symbiosis.

"The author concludes that (1) the tubercles of *Leguminosae* are not formed by a single specific bacterium, but that in different localities are to be found different organisms capable of producing them; (2) the Y-formed specimens, the so-called bacteroids, are very complex while in symbiosis with the plant, but later upon the dissolution of the tubercles they separate into simple bacilli, and as such they may be found in the surrounding soil. In the spring they enter the plants and form by their growth into new Y-shaped bodies; (3) the symbiotic relationship is not yet completely established, since the tubercle bacteria alone can not make the free nitrogen available for the plant, but it seems more probable that the plant itself without symbiosis can take up and assimilate free nitrogen; the bacteria, however, may assist the plant in contributing to its higher nitrogen content. Further, it is shown that in spite of the presence of bacteria, the plants do not take up any greater nitrogen content. From many recent experiments it is shown that not only a symbiotic but also a parasitic relationship exists between the plants and their bacteria; also that the effect of the bacteria and the method of nitrogen assimilation are not well known."

"Why is there so great a variation in the prices asked for ground bone?"

Ground bone varies greatly in value, and this will probably account for much of the variation in price; the degree of fineness more

or less affects its value to the farmers, and the finer it is ground, the more it costs the manufacturer; freight is also an item which more or less affects its cost to the local agent, and it is often the case that in the transfer of freight from one railroad to another, the freight is increased beyond the proper proportion.

In addition to the items of fineness and freight, the item of quality has probably a great effect upon the price. To illustrate, let us suppose a train load of bone just arriving at one of the larger fertilizer establishments; if ground as it comes, good and poor bones are all ground together; it has a fixed value, and is known to the trade as "the run of the pile;" but suppose, on the other hand, parties who are interested in the manufacture of umbrella handles and other ornamental bone work, select and take away the hard shin bones; suppose that another manufacturer interested in the sale of bone for sugar refineries takes out the next best in quality; suppose that one or two similar selections are made, each taking the best of what was left in the pile; the remaining bone would be, strictly speaking, pure bone, but would be greatly reduced in value as a fertilizer. The bones first taken were the best for the farmer, and might have been cheaper, if properly ground, at $32.00 per ton than that which is left is at $25.00, or even less. We think that it will be found that the item last mentioned has more to do with the price of ground bone than have the others.

"What is the meaning of the terms 'available,' 'soluble,' 'reverted,' and 'insoluble,' as found upon fertilizer sacks?"

These terms indicate the different forms in which the phosphoric acid of the fertilizer exists; in its original condition, whether made from animal bone or South Carolina Rock, the phosphoric acid is combined with the lime (forming bone phosphate of lime), in the proportion of three of lime to one of phosphoric acid, in the form of phosphate of lime, and to distinguish it from the other forms, is called "insoluble;" this term, however, at least so far as it relates to ground bone, is merely comparative, and should not be literally understood; for in bone it in reality becomes soluble, though much more slowly than when in the "available" or "reverted" form.

If the manufacturer adds the proper proportion of sulphuric acid and water to either the bone or South Carolina Rock, the acid breaks up the combination existing between the phosphoric acid and lime, and forms new compounds; in the case of the "soluble," the sulphuric acid unites with two portions of the lime, and forming sulphate of lime or gypsum, leaves the one proportion of phosphoric acid in combination with one of lime; this form, although the most expensive to the manufacturer, is of little or no practical advantage to the

farmer, because the fertilizer as soon as it is applied to the soil finds another proportion of lime which unites with the phosphoric acid, and with one proportion of lime which it already has, forms sulphate of lime or gypsum.

If, however, in the addition of the sulphuric acid and water, as is usually the case, with the largest proportion of the material, the sulphuric acid takes but one proportion of lime, we have left the phosphoric acid in connection with two proportions of lime, and in the form known as reverted, or "gone back;" the term given to it indicates that it has gone partially back to the insoluble form by obtaining one proportion more of lime.

The "soluble" and "reverted," when added together, form the "available" phosphoric acid; and as they are practically of the same value to the farmer, the manufacturers have been allowed to use the word "available," instead of, as the law requires, branding both "soluble" and "reverted." It is quite common to state the "soluble" and "reverted" as equal to a certain percentage of "available;" in such cases it should be remembered that they are equivalent to each other, and practically mean the same thing.

"What is the fertilizing value of hard wood ashes?"

All unleached wood ashes contain a varying proportion of phosphoric acid, but it is upon available potash that fertilizing qualities mainly depend.

Its value depends somewhat upon the kind of wood used and the degree of heat accompanying its preparation; in some cases, under a high degree of heat, the availability of its potash is impaired and a portion of its fertilizing value lost.

The following table gives the result of the analysis of ten carefully selected samples of unleached wood ashes, and shows the commercial value of each, in addition to the price per ton paid:

Number.	Moisture.	Phosphoric acid.	Potash.	Price paid per ton.	Commercial value per ton.
1,	13.89	1.44	5.84	$16 44	$8 47
2,	14.15	0.97	3.22	12 50	4 51
3,	13.34	1.49	6.12	13 00	8 22
4,	18.03	1.56	3.80	12 00	5 74
5,	11.30	2.45	7.71	14 75	10 93
6,	6.52	2.48	7.25	14 75	10 46
7,	10.83	1.83	5.96	10 00	8 39
8,	16.58	1.28	6.64	13 50	8 58
9,	21.00	1.56	6.49	12 50	8 70
10,	20.36	0.63	6.73	11 00	8 03

The average of the ten samples furnishes us with the following data, representing the analysis and value or average of unleached wood ashes: Moisture, 14.59; phosphoric acid, 1.57; potash, 5.97; cost per ton, $13.00; commercial value per ton, $8.24.

With chemical analysis as a guide, we may assume that the average unleached wood ashes now in the market cost the consumer too much, if he takes the value of the phosphoric acid and potash only, into consideration.

"What is the value of wool-waste as a fertilizer?"

Chemists assign a low value to this article, and many consumers of fertilizers are misled by its odor, and thus place an enormous value upon it. Odor cannot be taken as an index of the value of a commercial fertilizer; many commercial fertilizers and materials used in fertilizers owe their odor to the amounts of sulphur which they contain.

A certain brand of dissolved South Carolina Rock has been praised by consumers because of the strong and penetrating odor which it gives off; the consumer is not in all cases aware that this odor is due to the fact that refuse or "sludge" acid from oil works is used, and that it does not add anything to the fertilizing value of the South Carolina Rock not added by pure acid.

If odor was the desirable object, it can be obtained by mixing dry or air-slaked lime with any fertilizing material containing nitrogen; chemical changes which take place will release the nitrogen (ammonia), and great loss to the fertilizer ensues.

Wool waste often receives a fictitious value as a fertilizer, because of its strong odor when undergoing decomposition. It resists the action of the air and moisture, and decomposes slowly, and is not, therefore, as valuable as many other forms of nitrogenous material.

For the purpose of valuation, our chemists place wool waste upon very nearly the same level as leather scrap, and assign to both a very low commercial value.

"Is steamed bone as valuable per ton as raw bone?"

The effect of grease or oil, in bone, is to prevent the entrance of moisture from the soil and to prevent the decomposition and immediate action of the bone. If the oil has been removed and the bone perfectly dried, we will find that steamed bone will act quicker than common, raw or greasy bone. But the fact is, that, in many cases, the steamed bone is not properly dried, and when placed on the market, still retains a portion of the moisture absorbed during the

operation of steaming. The oil has, at least to a certain extent, been replaced by water, and instead of buying grease, the consumer is paying a good price for water.

Steamed bone should be supplied at a less price than green bones, because it is more readily ground, and with the same expenditure of power can be reduced to a much finer condition, and the oil being worth more as oil than as bone, adds another source of profit to the manufacturer.

If nitrogen is necessary, it is merely a question of economy, after the increased action of the bone is taken into account. It is a question of whether in buying oil or grease at bone price, the consumer is not acting improvidently, and whether he had not better buy the steamed bone and apply his nitrogen in some other form.

The factors involved are the cost of nitrogen, the relative cost of raw and steamed bone, the value of the oil extracted, and the more immediate action of the bone as a fertilizer.

"In his address this morning Secretary Edge spoke of 'soil food' and 'atmospherie food.' What did he mean?"

All farm crops are composed of these two classes of food, which, as the terms imply, are obtained either from the soil or atmosphere; there can be no other sources, and every farm crop must obtain all of its nourishment from one or the other, or both of these sources.

Fortunately for us, our crops obtain but a very small proportion of their food from the soil, and by far the larger amount of it comes from the atmosphere. The ratio between the two may be imagined from the difference between the weight of a load of hay and that of the ashes which result when the load is completely burned.

Soil food, or that portion of the substance which comes directly from the soil, is indestructible; it may and does change its form, but it still remains, and can at any time be reduced to its original formation.

Crops vary greatly in the amount of soil food which they consume or utilize; these two extremes are represented by a ton of butter and an equal weight of dry tobacco, the former containing soil food which may be replaced at a cost of about one-half dollar per ton, while the soil material in the tobacco crop cannot be replaced for many times that amount, and hence, it naturally follows that tobacco is, comparatively speaking, a very exhaustive crop, while butter and other fat products, exhaust the farm but little.

Common red clover may be cited as an example of a crop which obtains much of its nitrogen from or through the atmosphere, it having been proven that a soil from which a luxuriant crop of clover

has been taken contains more nitrogen than it did before the crop was grown, showing that the crop has, in some manner, obtained a supply of nitrogen from the atmosphere.

While it may be stated that certain portions of the crop always come from the soil, and that certain other portions come from the atmosphere, yet this application loses its force in the derivation of the nitrogen consumed by the crop, and it is also true that this derivation depends, as before stated, greatly upon the character of the crop.

It is admitted by all of our best authorities that corn, oats and wheat have no power to obtain their supply of nitrogen from the atmosphere, and that they must depend entirely upon the soil for their nitrogen supplies. It is equally correct that clover, and other leguminous crops are, at least to a certain extent, independent of the soil for their nitrogen supplies, but we need more practical knowledge as to the manner in which this supply is obtained.

"In compounding home-made fertilizers, what is the best form in which to obtain nitrogen?"

There is probably no one form of nitrogen to be recommended by itself; the various forms vary greatly in their availability, and it is usually best to obtain the nitrogen from more than one source, so that its action may be continuous. Of all of the commonly used forms, nitrate of soda is probably the most soluble, and at the same time, the most likely to be lost by leaching from rain, if moisture exists in large amounts.

Sulphate of ammonia is less soluble, and will probably not come into action until the small amount of nitrate of soda usually put in fertilizers has been exhausted.

The Rhode Island Station gives the following as the summary of their experience in the use of several forms of nitrogen:

"1. Nitrate of soda leaches more readily than sulphate of ammonia, thus making a wet season more favorable for the latter.

"2. The transformation and nitrification of sulphate of ammonia would be favored by considerable moisture.

"3. The sulphate of ammonia may furnish sulphur to the plant, and this is essential to its growth; it may also, by chemical changes which it sets in operation, render available other elements within the soil.

"4. The nitrogen in form of nitrate of soda is movable in the soil and in a form ready to act at once, even if the conditions for nitrification are unfavorable.

"5. The nitrate of soda may produce chemical changes in the soil different from those produced by sulphate of ammonia, by which other plant food is made available; the soda may partially replace potash and perform its function in a measure, as claimed by Wagner and Dorsch, who also state that it may, under certain circumstances, increase the yield by one-half, even when an abundance of potash is applied in connection with it. The soda may also (according to the same writers), increase the water capacity of the soil.

"6. It is claimed that like amounts of nitrate of soda will not always give like yields, even though all of the nitrogen is taken up by the plants; in the one case there may be a small crop, containing a high per cent. of nitrogen, and in another, a large crop, containing a low per cent. of nitrogen.

"7. Sulphate of ammonia may contain sufficient sulpho-cyanide of ammonia or other impurities, to make it poisonous to vegetation, though as now manufactured, this is not likely to be the case.

"8. It is possible that the ammonia may enter into combination in the soil, setting sulphuric acid free, which, if sufficient bases are not present to bind it, may be injurious to vegetation, or the sulphate of ammonia, if not transformed and nitrified, may perhaps exert a positively injurious action.

"9. It appears that there is a loss of nitrogen attending the nitrification of the sulphate of ammonia."

"Is the use of commercial fertilizers profitable at the present prices of farm products?"

This question might be answered by the statement that it depends entirely upon how the farmer purchases his fertilizers, and how much he pays for them; we could readily instance farmers who are throwing away half the money which they expend for fertilizers by an injudicious and extravagant selection; we could name cases in which one farmer has bought "Dissolved South Carolina Rock" at $14.50 per ton, while another has paid $25.00 for the same article, but under another name, and in bags branded differently; one may readily make the use of commercial fertilizers pay, while the other will as surely find loss in the practice.

It is safe to assert that one-fourth to one-third of the money expended for fertilizers is practically thrown away; this is equivalent to declaring that at least $1,000,000 is annually wasted in the purchase of fertilizers in our State alone; with this draft upon the farmers, it is not to be wondered at that some are ready to declare that the practice is not profitable, or, that in other words, it does not pay.

As another illustration of the reason why some fail to make it pay, we might instance farmers who are paying $30.00 to $35.00 per ton for a complete fertilizer when the same number of pounds of South Carolina Rock, costing half the money, would have given them as good results, and allowed them a margin of $15.00 per ton profit on each ton purchased.

It is the business of the farmer to convert fertility into farm crops and products, and sell them at a price above their cost; those who can do this make the use of fertilizers pay; those who cannot, will certainly find the use of fertilizers unprofitable. The fact that the fertility is purchased in the form of a commercial fertilizer does not affect the question as seriously as would appear at the first glance; fertility in the farm is worth just what it costs to replace it; the fertility in grain purchased is worth the same as if in fertilizers; the use of purchased grain merely gives the farmer a chance for two profits, instead of one; if he can turn the grain into a farm product and sell it for more than it cost him, he still has the manurial value of the fed grain as a source of further profit.

The question may very readily be converted into a more general one, and stated in the form of a doubt as to the profit of any kind of business which may be selected; in every trade there are those who make it profitable, and there are also those who, under apparently similar circumstances, fail to obtain any profit at all; in such cases the fault is not so much with the business as with the man, and the fact that some farmers do not make the use of commercial fertilizers pay does not prove the negative of the general question.

"Is a rotation of crops absolutely necessary to maintain the productiveness of the soil?"

Possibly not absolutely necessary, but under our system of agriculture, and with our present prices of agricultural products, a systematic rotation certainly presents the most economical plan of maintaining the productiveness of our soil. Under our present system of agriculture, the continued cropping with but one crop will exhaust the soil; but it is, however, possible, to continue the production of special crops by the use of manure and fertilizers for an indefinite length of time, but it is a question whether it can be profitably done.

Any rotation which includes a crop of clover every five or six years, and the turning under either of the clover sod or green clover, appears to best maintain the fertility of our soils.

In referring to this question, Prof. Flagg, of the Rhode Island Station, writes thus:

"Rotation of crops is important upon a dairy or stock farm, because a variety of crops is produced, and cattle thrive better upon a good assortment of foods than when confined to one diet. If soiling is practiced, rotation is still more important in order that a succession of green crops in just the right condition for feeding may be had through the season.

"Rotation offers still another advantage in distributing the work of planting, cultivating and harvesting over a greater period of time, so that a small force of labor can cultivate and care for more crops in the aggregate, than when limited to the short season adapted to any one crop. The labor of the farm can be utilized to better advantage when a variety of crops is grown, than when but one is planted."

In summarizing his views upon this topic, Prof. Flagg uses the following language in relation to rotation:

"1. It economizes the natural and artificial supplies of plant food in the soil, and helps to enrich the surface soil.

"2. A regular succession of crops, including hoed crops, is of great assistance in keeping the soil free from weeds, insects and fungoid diseases.

"3. It economizes the labor of the farm, and is necessary for the satisfactory and profitable feeding of live stock.

"4. By the frequent plowing in of turf, clover sod and stubble, the mechanical condition of the soil is improved, while activity of chemical, physical and bacteriological forces is greatly increased, resulting in a greater development of plant food."

"Other things being equal, does the color of the soil exercise any effect upon crops?"

It is probably wrong to assume that when color varies, other things can be equal; any variation in color is due to the presence or absence of certain materials in the soil, and the very fact of their presence or absence, regardless of color, may affect the crops. In a majority of cases, the color of the soil is more or less affected by the proportion of vegetable matter which they contain; thus, peaty soils, which are always rich in vegetable matter, are always of a dark color, and on the other hand, sandy soils, which are always destitute of vegetable matter, are usually of a light color, or partake of that of the sand of which they are composed.

Dr. Wolley, in referring to color in soils, writes as follows:

"This (color) is due to the presence of certain constituents. The principal mineral ingredients of the soil (clay, lime and quartz) are white when pure. When the soil is of some other color, it is caused

by the presence of humus matter or iron compounds. The humus substances produce a gray, brown or black color, according to the quantity present, while iron, as ferric oxide or hydrate, causes a yellow brownish or red color. The coloring power of these constituents depends on the constitution of the soil. In sands of 0.2 to 0.3 per cent. of humus matter, or 1 per cent. of ferric oxide, or hydrate is sufficient to cause either a gray or red or brown coloration in the dry state, but clays more (2 to 5 per cent. humus, 5 to 10 per cent. ferric oxide or hydrate), is required to produce the same effect. This is due, as a rule, to more intimate mixture of the clayey soils with the coloring matters. A green coloration is almost without exception caused by ferrous compounds, and is seldom noticed in well aerated soils.

"A change in the color of soil is caused on the one hand by a change in humidity; on the other by a change in the iron compounds. In general, soils are darker colored when they contain more water, and vice versa. This is especially true of the soils containing humus, which are dark brown or black when wet, become lighter as moisture decreases, and when dry, show a gray or whitish gray color. Soils colored red or brown by ferric oxide or hydrate, assume a lighter color, and under certain circumstances (deficiency in air), a greenish color when these compounds are converted into ferrous compounds. The reverse process, i. e., the oxidation of ferrous salts is shown by an immediate change in the color of the mass to yellow, red or brown."

Accepting Dr. Wolley's statements as correct, it is safe to assume that color has more or less to do with the character and productiveness of the soil, because color is influenced by the presence or absence of materials which are beneficial or prejudicial to crops; and second, because color is largely affected by the amount of moisture in the soil.

It will also be admitted that black and peaty soils (probably black because they are peaty, or contain a large percentage of vegetable matter) will absorb and hold the heat of the sun longer; they become warmer earlier in the morning. and remain warmer longer in the evening, and thus practically lengthen out the period of growth. Light and sandy soils are always deficient in moisture, and thus they more or less affect crops.

"Are commercial fertilizers safe applications for a tobacco crop?"

In the annual report of the State Board of Agriculture for 1881, F. R. Diffenderffer, of Lancaster, answered the question in the following manner:

"The general rule, however, as we have already stated, is to plow corn ground in the spring for the purpose of preparing the tobacco field. Two or three weeks before plowing, haul out your manure, and, let us say right here, put on nothing but stable manure. The experience of the past quarter of a century has unmistakably pointed out that no other fertilizers so far used, gave such excellent results. We do not think we err in saying that much of the reputation that Lancaster county tobacco has so justly acquired, is due to the almost exclusive use of barn-yard manure. We cannot impress this fact too earnestly on the minds of our tobacco growers. We do not say that artificial fertilizers have not given good results. The tobacco grown by their use is, however, not in favor with packers or manufacturers. It burns with a darker and less compact ash; whereas, with a good soil and well rotted barn-yard manure, a tough, light-colored ash is almost certain to result. If the buyer is aware that artificial fertilizers have been used, he will rate the crop lower than if barn-yard manure had been put on the field. Let no tobacco grower lose sight of this fact."

"May not the atmosphere, with an occasional crop of clover turned under, be depended upon to maintain the fertility of the soil?"

Possibly these agents might be depended upon, but if so, will it pay? The correct object of successful agriculture is to obtain fertility at the lowest possible cost, and turn it into crops which will give the highest market prices. While it is true that more or less fertility in the form of nitrogen can be obtained from the atmosphere, it may pay better to purchase it in some other form, rather than to wait for its elaboration from this source, and its storage in the soil by the roots and leaves of the clover crop.

If a fair profit can be made by the production of milk, butter, beef or mutton, it will usually be found more profitable to use the clover in the form of hay and save the resulting manure, and apply it to the same field. The value of a ton of clover hay when consumed as food and returned in the form of manure, when added to the profit in feeding the crop, will usually pay better in central and southern Pennsylvania than using clover directly as a green manure.

Clover possesses one advantage over almost any other crop that can be selected for turning under, and this is, that it has the power, through its long and deep running roots, of bringing up fertility from the sub-soil, where it is out of reach of the roots of the crop, and by storing it in the stems, ultimately restore it to that portion of the soil, upon which the roots of the succeeding crops forage for their food.

The whole question of fertility is one of cost, and may be repre-

sented by dollars and cents, and it is quite possible that it may pay to purchase and add fertility to a comparatively fertile soil. We can only obtain fertility by purchase or by stealing it from the soil; if any crop obtains an increase of fertility from any source, and that crop is sold off the farm, there is no gain in the amount of fertility; but, if on the other hand, the increased crop is fed on the farm and the manure properly taken care of, there is a decided increase in the stock of fertility.

It is possible to add phosphoric acid, potash and nitrogen in some of their more soluble forms, and in such a condition that in seasons of deficient moisture, the crops may obtain them, when they could not have obtained them from the soil directly. Soil fertility as it naturally exists, is not in the most soluble condition, and becomes available to the crop but slowly, and when moisture is deficient, the crop very often suffers for want of available food, even in a soil not deficient in fertility.

The profit of farming depends upon the difference between the amount obtained for a given crop and its actual cost, and the whole question of successful agriculture resolves itself into the purchase and sale of fertility; the successful farmer must obtain his fertility cheaply, and dispose of it in his crops for a good price, or there is no profit in his work.

"Is there not a constant tendeney in the soluble phosphoric acid in South Carolina Rock to revert, or go back to an insoluble condition?"

The indications are that, after application to the soil, such a reversion does, to a certain extent, take place, and it also appears that the amount of this reversion is dependent upon the presence or absence of certain salts of iron in the soil; if these are present, the reversion is often very rapid, and it has been proven that the application of soluble phosphoric acid to certain soils containing iron is a positive loss, the reversion being so rapid, and the insolubility so strong that the crops can obtain no benefit from the application.

In referring to this reversion, before the fertilizer has been applied to the soil, Dr. Smetham writes: "Where fine grinding is the rule, and where the mixing is complete, and the acid usually in excess of that required for the transforming of the tri-basic phosphate to the mono-basic form, reversion due to the formation of a di-basic phosphate is seldom met with."

To this the Experiment Station Record adds the following:

"When, however, as is usually the case, the original phosphate contains an appreciable amount of oxide of iron or alumina, it is found that the solubility of the phosphoric acid of the superphos-

phate diminishes to a considerable extent on keeping any quantity over, a very small percentage of oxide or iron and alumina being considered as reverting double its weight of soluble phosphate."

The Station Record mentions the case of "A super-phosphate which showed, when made, 36.5 per cent. of soluble phosphoric acid, contained at the end of a year, 38.19 per cent., and it is noted that in the case of high percentages, there is frequently an increase, rather than a decrease of soluble phosphoric acid from keeping."

Dr. Smetham writes: "A review of the facts already obtained makes it pretty certain that there is a wide difference in the behavior of the oxide of iron and alumina in the manufacture of super-phosphate. The first, for practical purposes, seems to revert phosphate in what may be called theoretical proportion, or as nearly as possible, two parts of phosphate to one of oxide of iron, while the alumina, which, if acting in the same manner as oxide of iron, would revert three times its weight of phosphate, at most seems a retrogression of its own weight. It has long been known that super-phosphate manufactured from Florida phosphate increases in the percentage of soluble phosphate instead of retrograding, and as this phosphate contains scarcely any oxide of iron, and but two to three per cent. of alumina, it was difficult to understand this behavior. The foregoing results, however, explain the matter.

"Under the circumstances, and especially as many of the phosphates now coming into the market contain alumina in larger proportions than oxide of iron, it appears to me that there is a pressing need for a revision of the terms of contracts on which phosphates are usually sold, and for a differentiation of oxide of iron and alumina on the analysis upon which the sales are made."

"In his talk this morning, Secretary Edge stated that in some cases the application of lime was equivalent to an application of potash. What did he mean?"

There can be no room to doubt that much of the benefit derived from lime, and practically all the benefit derived from its application to soils destitute of vegetable matter, is in its ability to break up compounds which it meets in the soil, and from them, form new combinations; if, as undoubtedly is often the case, it happens that the compound, as it originally exists in the soil, is not valuable as plant food, and if, as is also often the case, the new compound formed is available as plant food, good results follow the application of lime. If, for instance, lime should find in the soil a combination of potash with some acid forming an insoluble material, and if the lime in breaking up the potash compound unites with the acid and liberates

or renders the potash soluble, the effect would be precisely the same as an application (direct) of potash in some one of its soluble forms. Upon certain classes of soils, it is, therefore, found that it is simply a question of economy for the farmer to decide whether he will apply lime, or make a direct application of potash; either will answer, and it becomes simply a question of cost, depending altogether upon the relative cost of the lime and of sulphate of potash.

Careful examination will show us that the result of the application of lime to soils rich in vegetable matter results in making that vegetable matter available as plant food; and it is also evident that too much value has been placed upon this action of lime, and too little of the effect attributed to the action of the lime, in breaking up and remodeling compounds in the soil, otherwise valueless as plant food; and if we wish to be fair, we must hereafter give the lime due credit as a key which unlocks the storehouse of insoluble plant food, and makes a portion of the contents available or soluble.

"Upon what sources can plants depend for their supply of nitrogen?"

Prof. Breidenbaugh thus outlines the sources of plant nitrogen:

"1. Almost all, if not all, the nitrogen contents of all vegetation is derived by the plant from, or through the soil. It has been maintained by some that certain orders of plants, particularly from among the agricultural vegetables, the broad leaved root crops, derive at least a portion of their nitrogen through their leaves, from the atmospheric nitrogen or nitrogenous compounds. This, to say the least, is very doubtful.

"2. Nitrogen exists in the soil in three classes of conditions; those compounds which are insoluble, and are the intermediate products of vegetable decay, classed as nitrogenous organic bodies, etc.; the soluble compounds of nitrogen, including ammoniacal and nitrate salts; free nitrogen, held in solution in soil, water or in the air, held in the pores, or condensed in the surfaces of the pores of the soil.

"3. The nitrogen of the soil is derived from these four sources: From the decay of former vegetation as stored in the soil; from the air, carried down as ammonia, nitrates and organic dust in solution, or suspensions in falling rain, snow and dew; from the circulation of the air through the pores of the soil; from additions in the form of barn-yard manure, or chemical artificial fertilizers.

"4. Nitrogen in the insoluble form, and as free nitrogen cannot be assimilated by the plant. Hence, the two forms of nitrogen are ammoniacal and nitrate salts, and in the light of our information on the subject, it seems very probable that it is in the latter form, or as ni-

trates, that the plant finds the conditions in which it is best able to avail itself of nitrogenous food offered to it.

"5. The soil has, to a certain extent, the power of retaining within itself, the soluble nitrogen compounds (ammonia and nitrates), by partly physical, but more chemical absorption."

"Will it pay to purchase commercial fertilizers to produce sixty-five cent wheat?"

This question might very properly be answered by asking whether the production of sixty-five cent wheat, by any process, would pay? The reported experience of over 250 Pennsylvania wheat growers, as shown by the reports of the State Board of Agriculture, indicate that the farmer who sells wheat at sixty-five cents does so at a loss of at least ten cents per bushel. This is, of course, acting upon the supposition that all expenses are to be charged to the wheat crop, and that six per cent. interest is to be charged for the use of the land.

If the grain alone is taken into consideration, the Pennsylvania farmer cannot produce wheat for less than seventy-five cents per bushel when all the items which enter into its cost are taken into consideration, and hence, we may answer that if it pays to produce sixty-five cent wheat at all, it will pay to use commercial fertilizers on it.

But it is not fair to charge all of the expenses to the grain alone. Many of our farmers must have the straw, and that alone is worth a considerable amount per acre to them, and it cannot be purchased at reasonable rates, for all want it.

Another fact worthy of consideration is, that the crop is one which cannot be eliminated from our present rotation; we must have wheat, in order that we may have grass, and for this purpose alone, the wheat crop may be fairly credited with five dollars per acre, thus reducing the cost of its production by that amount, or at an average rate of not less than two and one-half to three cents per bushel.

Taking all the items of rotation, production of grass, necessity of the crop in the rotation, we may answer that it will pay to use commercial fertilizers for the production of wheat, even at the present prices.

Nor is it just to charge all of the commercial fertilizer to the crop of grain, for the crop of straw is also considerably increased, and if a proper fertilizer has been used, the ensuing crops of hay are also materially increased.

Suppose that a commercial fertilizer to the value of three and one-half dollars per acre has been applied. What increase in grain and

the following crops of hay must we expect in order to render the investment a profitable one? Let us suppose that by the application of the fertilizer we have increased the crop of grain but three bushels per acre. We then have a credit to the fertilizer of two and one-quarter dollars per acre, and have left but twenty-five cents per acre of our expenditure. Again, suppose that the fertilizer increases the hay crop to the rate of but one-quarter of a ton per acre for the next two years, or a total increase of one-half ton per acre. This will give us a credit for the fertilizer of not less than three dollars per acre, thus showing that the increase in the two crops of hay will pay for the fertilizer. Thus far we have not taken into account the increased value of the straw, nor the increase to the manure pile by feeding the increased amount of hay. Again, we think that it may be demonstrated that it is profitable to use commercial fertilizers, even at the present low prices of grain.

"Can we expect as good results from the application of commercial fertilizers as from barn-yard manure?"

If this query is propounded to ten farmers coming from different portions of our State, we would probably receive as many different answers, or, at least, as many answers, varying greatly in their conclusions. Such questions can only be determined by a series of experiments in which results are only arrived at after carefully weighing and measuring; there must be no guessing or estimating, but everything must be conducted in the most careful manner.

The result of twelve years of experiments at the Pennsylvania State College Experiment Station will probably furnish us with the best and most reliable answer to the question. In these experiments, the land is described as a "limestone clay loam, about eight inches deep, with good natural underdrainage, and containing a fair supply of organic matter." The rotation was that of wheat, clover and timothy, corn and oats. The manure and fertilizers, as specified in the following table, were put on for corn and wheat, or twice during each four years' rotation.

In the table "nothing" is taken as the zero point, and results are shown, above or below, by the figures opposite each fertilizer mentioned in the table:

Fertilizer.	Ammonia.	Phos. Acid.	Potash.	Value.
Nothing,	.....	.....	.....	100
Dried blood,	29	.....	.....	96
Dissolved boneblack,	.....	48	.....	104
Muriate of potash,	.....	.....	100	98
Dried blood and dissolved boneblack,	29	48	.....	117
Dried blood and muriate of potash,	29	.....	100	102
Muriate of potash and dissolved boneblack,	.....	48	100	120
Muriate of potash, dried blood and dissolved boneblack.	29	48	100	119
Muriate of potash, dried blood and dissolved boneblack.	58	48	100	127
Muriate of potash, dried blood and dissolved boneblack,	86	48	100	130
Muriate of potash, nitrate of soda and dissolved boneblack,	29	48	100	127
Muriate of potash, nitrate of soda and dissolved boneblack,	58	48	100	129
Muriate of potash, nitrate of soda and dissolved boneblack,	86	48	100	131
Sulphate of ammonia, muriate of potash and dissolved boneblack,.	29	48	100	127
Sulphate of ammonia, muriate of potash and dissolved boneblack,.	58	48	100	136
Sulphate of ammonia, muriate of potash and dissolved boneblack,.	86	48	100	131
Yard manure, 12,000 lbs,	65	43	55	122
16,000 lbs,	87	57	73	121
20,000 lbs,	108	72	92	121
Yard manure and 4,000 lbs lime,	65	43	55	122
Lime, 4,000 lbs,	.....	.....	.....	92
Ground limestone, 4,000 lbs,	.....	.....	.....	102
Plaster, 320 lbs,	.....	.....	.....	101
Ground bone, dried blood and muriate of potash,	36	48	100	129

"What is the best form of nitrogen to use in a home-mixed fertilizer?"

The variations in the value of the different forms of nitrogen is largely due to their solubility; thus, nitrogen from nitrates is the most expensive, costing 14 cents per pound at present market prices, and it is also the most soluble form on the market; at the other end of the value list, we find coarse bone and tankage the nitrogen of which costs but 7 cents per pound, or but one-half that of the nitrate nitrogen; and yet it is a fact that a pound of the seven cent nitrogen may be worth more in a fertilizer than one of the class which costs fourteen cents.

No well posted manufacturer of fertilizers would derive his nitrogen wholly from either source, for that from coarse bone may be so slow in its action as to confer but little benefit upon the plant during its

early growth, while the nitrogen of the nitrate will either have all been used up, or will have washed into or through the soil before the latter growth of the crop can utilize it, hence we find that manufacturers who study the effects of their fertilizers always use nitrogen from several sources of varying solubility, so that, as far as is possible, to have a portion at all times available until the whole has been used up.

The nitrogen in bone of different degrees of fineness is valued at different prices, varying from seven to fourteen cents per pound, in accordance with the fineness of the bone; that in the finer grades of bone being quickly available, while that in coarse bone remains intact for a considerable length of time, or until the structure of the bone is broken down by soil action and its nitrogen released as plant food.

The scale of valuations adopted by the chemist of the Department is as follows:

Nitrogen in ammonia salts, ...	13½	cents per pound.
Nitrogen in nitrates, ...	14	cents per pound.
Nitrogen in dry and fine ground fish, meat and blood, and in mixed fertilizers, ...	14	cents per pound.
Nitrogen in cotton seed meal and castor pomace, ...	12	cents per pound.
Nitrogen in fine bone and tankage, ...	10	cents per pound.
Nitrogen in medium bone and tankage, ..	9	cents per pound.
Nitrogen in coarse bone and tankage, ...	7	cents per pound.

It is advisable to use nitrogen from at least two sources in any and all kinds of fertilizers, except possibly spring top dressing, in which immediate action is wanted; in these nitrate nitrogen may be used, as the first rain makes it available to the growing crops.

"The Secretary alluded to 'Alkaline fertilizers' this morning; what did he mean?"

The term "alkaline fertilizers" has, by habit and custom, been applied to such fertilizers as contain no nitrogen and which contain the three forms of phosphoric acid and potash; they have several advantages, and undoubtedly have their proper place in fertilizer economy.

Nitrogen is by far the most expensive element used in complete fertilizers. Many farmers and dairymen have as much or more than they need of this element in their yard manure, especially if they purchase food stuffs and use them on the farm, and money expended for this element is, to them, practically wasted. In agricul-

ture of this calling, the "alkaline fertilizer" fills a niche not to be filled in any other manner; it is not filled by an acidulated South Carolina Rock, because this contains no potash, and such farms and such soils usually need more or less potash, and to make use of a complete fertilizer, is, practically, to throw from two to four dollars per ton away in the value of the nitrogen not needed.

One drawback to the free use of this class of fertilizers has heretofore been, and in some districts still is, that they have been too high priced; too many farmers look upon a "fertilizer" as a fertilizer, and seem to have the idea that the lower the price per ton, the better it will suit their farm, crop and pocket. Manufacturers, taking advantage of this carelessness of their interests on the part of farmers, ask a price for alkaline fertilizers which, while considerably below that of complete fertilizers, is still higher than the market price of the ingredients warrants.

If dissolved South Carolina Rock can be purchased at wholesale for $8.00 per ton, and kainit or other fairly good potash salts for $10.00, and they are mixed in equal parts, it is evident that $18.00 to $20.00 per ton is too high a price for the mixture, and that farmers who pay such prices are giving more than market price for plant food.

"Have any experiments been made in this country to prove the value of the tubercles which are supposed to enable the clover plant to obtain nitrogen from the air?"

The Alabama Experiment Station (Bulletin No. 87), reports a series of experiments with imported material, but the test was confined to crops not grown this far north. These experiments were mainly confined to crops or plants grown in pots, and thus lose much of their value to the practical farmer.

The method of "inoculation" or application of the tubercles is given as follows:

"One-half bottle of imported nitragin or germ fertilizer (a gelatinous material containing immense numbers of specific living germs), was diluted with well water and sprinkled on about 25 pounds of earth, and one gill of this was then mixed with the upper soil of the odd numbered pots. A bottle of 'clover nitragin' was used for the pots intended to be inoculated for clover, and a bottle marked 'vetch nitragin' for the inoculation of the vetch pots."

The bulletin, by illustrations, shows the crop on each class of pots (those inoculated and those without any special preparation), and appear to show considerable increase from the presence of the tubercles.

The results of the experiment are, however, somewhat injured by the statement from the Bulletin, that "many soils are naturally supplied with the tubercle producing germs through the growth of wild leguminous plants. Moreover where a given legume is extensively grown, there is probably a wholesale inoculation of surrounding soils by means of the wind which carries the germ laden dust."

"Can any one give us formulas for mixing fertilizers for general use?"

The following have been recommended by those who have given them a fair trial, and their actual analyses is attached to each one:

Ingredients Used.	Actual Analysis.	
834 pounds dissolved boneblack. 666 pounds of tankage. 208 pounds of sulphate ammonia. 292 pounds of muriate potash. 2,000 pounds.	Soluble phosphoric acid, ... Reverted phosphoric acid, ... Insoluble phosphoric acid, ... Potash, ... Nitrogen, ...	5.73 2.38 .09 7.89 4.94
450 pounds tankage. 450 pounds ground bone. 232 pounds sulphate ammonia. 384 pounds dissolved boneblack. 305 pounds muriate potash. 179 pounds high grade sulphate potash. 2,000 pounds.	Soluble phosphoric acid, ... Reverted phosphoric acid, ... Insoluble phosphoric acid, ... Potash, ... Nitrogen, ...	2.70 4.95 1.54 14.07 4.69
132 pounds sulphate ammonia. 530 pounds tankage. 400 pounds ground bone. 670 pounds dissolved boneblack. 267 pounds muriate potash. 2,000 pounds.	Soluble phosphoric acid, ... Reverted phosphoric acid, ... Insoluble phosphoric acid, ... Potash, ... Nitrogen, ...	6.20 3.94 1.62 6.61 4.51
166 pounds sulphate ammonia. 666 pounds tankage. 834 pounds dissolved boneblack. 334 pounds muriate potash. 2,000 pounds.	Soluble phosphoric acid, ... Reverted phosphoric acid, ... Insoluble phosphoric acid, ... Potash, ... Nitrogen, ...	6.14 2.02 .64 9.35 4.48
450 pounds tankage. 170 pounds sulphate ammonia. 100 pounds ground bone. 1,000 pounds dissolved bone black. 280 pounds muriate potash. 2,000 pounds.	Soluble phosphoric acid, ... Reverted phosphoric acid, ... Insoluble phosphoric acid, ... Potash, ... Nitrogen, ...	7.48 3.10 .83 7.62 3.90

THE DAIRY AND DAIRYING INTERESTS.

"What is the food cost of a pound of butter?"

An answer to this question is very difficult from the the fact that so much depends upon factors which are not stated; if all the materials used as feed are purchased, the question should have one answer; if these products are all produced upon the farm the answer will be different, because the production of the butter saves the marketing of the raw material, and being on the farm, saves the cost of bringing the purchased food to the farm.

At a recent meeting of the Creameries' Association of Ontario, Canada, an address was delivered, a portion of which answers this question as follows:

"There are several important factors which enter into this question—the man, the cow and the feed. The food-cost of a pound of butter depends upon the man who is doing the feeding, upon the cow to which the food is given, upon the kind of food, whether suited to milk production or not; upon the milker—a poor milker may easily increase the food-cost of the butter; upon the man who handles the milk; an ignorant, unskillful person wastes or spills a portion of the butter given by the cow, adds to the food-cost of that which is saved or well-made, and, finally upon the man who markets the finished product. It will be noticed in the foregoing that the 'man' enters into this problem five times, the 'cow' once and the 'food' once. Therefore, five times as much care should be given to the 'man' as either of the other two factors."

One of the professors of the Agricultural College at Guelph, Canada, answers the question by theory experience at the college, where feed, milk and other products were all weighed during the year 1896, the milk of each cow carefully tested. From the report of this experiment we condense the following:

The highest yield of butter per cow was 424 pounds, and the lowest 120 pounds; the average yield per cow was 244 pounds. The highest food cost per pound was 22.2 cents and the lowest 8.8 cents, the average being 13.9 cents per pound. The cow's butter which cost 22.2 cents per pound lost her feeder $2.69, while the one making the butter at a food-cost of 8.8 cents per pound made her feeder a profit of $47.30 —the butter in both cases selling for 22 cents per pound.

Of the two following tables, the first shows the food cost of the butter only, while the second shows the food cost of the milk per gallon, the butter per pound and the cheese per pound:

Month.	Number Cows Milking.	Food Cost of 1 lb. Butter.
		c.
December, 1895,	16	18.8
January, 1896,	16	14.0
February, 1896,	15	12.3
March, 1896,	17	13.6
April, 1896,	18	10.4
May, 1896,	17	6.7
June, 1896,	21	4.2
July, 1896,	22	8.3
August, 1896,	24	12.6
September, 1896,	21	17.3
October, 1896,	22	15.3
November, 1896,	20	12.5
Average for year,	19	12.1

Month.	Number Cows Milking.	The Food Cost of		
		1 Gal. Milk.	1 lb. Butter.	1 lb. Cheese.
		c.	c.	c.
December, 1895,	16	8.60	18.8	8.4
January, 1896,	16	6.20	14.0	6.1
February, 1896,	15	5.75	12.3	5.5
March, 1896,	17	6.30	13.6	6.1
April, 1896,	18	4.60	10.4	4.6
May, 1896,	17	2.80	6.7	3.0
June, 1896,	21	2.00	4.2	1.8
July, 1896,	22	3.70	8.3	3.7
August, 1896,	24	5.09	12.6	5.6
September, 1896,	21	7.74	17.3	7.7
October, 1896,	22	7.20	15.3	6.8
November, 1896,	20	5.90	12.5	5.6

The low cost of the products in the months of May, June and July is explained by the fact that the pasture was charged at $1.00 per month per cow, and that the cows had more than the pasture, a portion of the time no meal at all being fed.

"What is the cause of what is known as ropy milk?"

A number of years ago the experience and observations of the writer led him to enumerate the following as among the peculiarities

of this trouble, and also possibly some of its causes, and he has had no reason to change them since:

That the trouble is often not apparent when the milk is first drawn from the cow.

That, after standing a short time, the ropiness commences to develop and increases rapidly in extent and viscidity.

That in many cases it is scarcely to be detected in the milk, but is shown to an unusual extent in the cream.

That some cows are predisposed to it to a much greater extent than others.

That it is more likely to show itself during hot weather following an unusually dry time.

That it is more prevalent during that portion of the season when the difference of temperature between day and night is most marked, or when we have a succession of hot days followed by cool nights.

That it is most prevalent when the animals are not provided with the proper shade or other shelter from the hot sun.

That it is most commonly absent or least prevalent during cool and moist summers and autumns.

That animals having plenty of running water, shade and regular supply of salt are rarely affected.

That the theory that small doses of saltpetre administered every other day will cure or prevent the evil, has no foundation in fact.

That all of the surroundings of the disease lead to the conclusion that, whether caused by fungoid growth or not, it is in fact a species of partial decomposition.

That it is due to a disease in the system of the animal, and that, to be effective, all cures must begin there, and that external remedies, while they may possibly mitigate the trouble, are not to be depended upon.

That a careful examination of each cow's milk will usually show that the whole mixed milking is infected by the milk of a single cow, and that the evil is not as widespread as some are inclined to suppose. That the fact that, without any changes in the local surroundings, it will disappear as rapidly as it came, warrants the conclusion that it is due to some temporary disarrangement of some of the animal secretions.

That cows which have access to both upland (artificial) and meadow pastures are least likely to be affected by the trouble.

That it is quite probable that the fungoid growth which is found in the milk may be the result of the partial decomposition, and not its cause.

"Should dehorning be prohibited by law?"

The only possible argument which can be made for the affirmative of this question is, that it inflicts pain upon the animals, and is, therefore, cruel. But even this argument, admitting that it inflicts pain, might be used to prevent many other operations which are believed to be absolutely necessary for safety and profit, and which inflict more pain than dehorning.

Our animals were given to us to make use of to the best advantage and with the least possible cruelty, and by inflicting the minimum of pain. Those who have noted the gentleness with which dehorned animals will herd close together, and drink out of the same water trough, like so many sheep, certainly cannot long use the argument of cruelty; in many cases, an animal which has been gored, suffers more pain for days at a time, than is even inflicted by dehorning, and such injuries cannot be inflicted after the horns have been removed. The argument made, that "if the Creator had not intended cattle to have horns, they would not be found upon them," has little or no force; with equal argument, it might be stated that if it had not been intended to be there, the bitter hull would not be upon the walnut and other nuts. The fact is that our dairy animals are not in a state of nature; we have changed their habits, and have placed them under abnormal conditions, in which horns are not only entirely unnecessary, but also a disadvantage, and a general nuisance, not only to those who are compelled to be among them, but also to animals in the same enclosure.

The best answer to the question would be to show the querist thirty or forty head of cows, with their horns in working order, and the animals confined in a small yard, and then show him the same animals in the same enclosure and under the same conditions, except that of the removal of the horns, and the question would be answered in the most practical and convincing manner.

Much of the argument used against dehorning is sentimental, and comes from persons who have very little practical experience with animals, and who know little or nothing of their habits and characters. When a little practical light is thrown upon the question, this sentimental feeling vanishes, and the recent opponent of the practice becomes a convert.

The horns were placed upon the animals as a defense against their enemies; we have placed them under conditions in which the danger from these enemies has been removed, and with their removal the necessity and use for the horns has vanished.

"Will potatoes fed to milk cows injure either the milk or the butter?"

Yes, if fed in too large quantities; they contain very little of real food value, and the result produced by their use is mainly medicinal and laxative, rendering the dry winter feed more like grass in its effects. It has also been found that a larger amount of potatoes can be fed with some rations than with others without producing any bad effects. It is claimed in New York state that cheese may be injured by a too liberal use of raw potatoes, and that a peculiar taste may be imparted to butter.

"Can a dairyman with ten cows profitably use the Babcock test?"

Certainly he can; and the only difference between him and the one who has twenty cows is that it will take him rather longer to get his money back but it is just as sure to come back in the one case as the other.

The fact is that to make butter at present prices pay, we must make use of every possible plan of reducing the cost; we cannot affect the market value very materially and hence, if we are to make a profit at all, it must be by decreasing its cost. As our dairies now run it may be stated that about one-third of the cows about pay their way, and that one-third are merely boarders which we keep simply for the fun of keeping them. This makes it evident that it is the other third that gives us all the profits, and we want as many of them as possible. In no way can we quicker or more surely pick out the profitable cows than by the use of the Babcock test and the scales; by their use we may each year weed out the animals which are not paying their way, and replace them by such as will at least pay for their keeping if not yield a profit.

Dr. Sturtevant once asserted at a meeting of the Board of Agriculture that if a discriminating Providence would strike down 350,000 cows in our State, the dairymen would be better off, for they were keeping about that number which either were eating their heads off or were barely paying for what they ate. Certainly use the Babcock test even for five cows and only retain such of them as are shown by the test to be profitable.

"Does it pay to cook feed for hogs?"

The economy of cooking feed of any kind is dependent upon the amount of additional nutriment that can be economically obtained from the food; the word economically as used here is very important and upon it depends the whole profit of the work.

The starch of the grain is enclosed in cells of comparatively insoluble material; some of these are not broken by the operations of grinding and of mastication and also escape the dissolving power of the digestive fluids and are lost; the object in cooking is to save these and utilize them in the production of pork. That they can by boiling be rendered available cannot be denied, but with even this admitted it does not follow that it is profitable to cook such food.

If the expenses of cooking exceeds the value of the food saved it is evident that, leaving the benefit of warm food out of the question, it would have been more profitable to have expended this cost in the purchase of more food, but in the consideration of the question we must take into consideration the benefit which is to be obtained from feeding warm food, and especially in cold weather, this is an important integer.

So far as our own practical experience goes, we believe that, unless the heat used can be that wasted by some other process or manufacture, the cooking of feed for pigs will not pay. The cost will be greater than the value of the food saved, and that the gain by the warmth of the food will not yield enough profit to make it pay. As a proof of this we do not know of one of the many experiments in this direction which have been continued any great length of time.

"Does it pay to raise roots for stock food?"

If this question is answered from the standpoint of feed only and value as actual feed only, it will have to be answered in the negative, but at the same time it must be remembered that there is a value in connection with feeding roots that should be counted but which in very many cases is lost sight of. Roots exercise an effect upon the health and thrift of the animal which cannot be credited to their food value only. Let us illustrate this in this manner. It may be profitable to feed roots in small amounts to dairy cows if ensilage is not used but where ensilage is used they are not profitable because the ensilage will accomplish the same effect at a much less cost and at the same time add greatly to the actual food value of the material.

We are apt to place our valuation of roots upon the result of English or European feeding, forgetting that there they do not have to compete with our cheap corn crop. It must be admitted that we have no feed that can be produced cheaper than corn, corn fodder and ensilage, and that this fact must be taken into account in making up our feeding ration.

It has been claimed that four acres of corn and one of good roots will feed more and produce better results than five acres of corn alone, and this may be the case, but if we count the cost of the acre

as against the cost of the extra acre of the corn and to this add the increased cost of preparation and feeding, we think that the statement will not hold good, and that if ensilage is taken into consideration, it will not hold good at all.

"Is cob-meal a profitable feed?"

After the corn is glazed all the food value of the crop is either in the stalk, leaves, grain or cob, or in other words it is all "above the ground" and no amount of delay will do more than transfer it further on towards its ultimate end, the grain. After it leaves the soil it gravitates towards the grain and as the stalk and leaves ripen their value as food is decreased by the passage of feeding value into the stalk and through that to the grain.

If this is the case it follows that the dry and mature cob contains very little that has food value, and that the longer the grain remains on the cob, the less this value is. When the corn is first cribbed the food value has not all left the cob and gone into the grain and hence it is safe to infer that a portion of it may be recovered by grinding the cob, but after the latter has become dry and woody it certainly has but little of food value left and what little there is can be supplied much more economically in some other form.

Usually, if the grain is ground cob and all, the miller tolls it to the extent of one-eighth while the shelled grain is only tolled one-tenth; this difference we think destroys all the gain that can possibly come from feeding the dry cob, and the claim that cob meal contains certain elements which were mixed with the ground grain give it stronger digestive powers may be met by the statement that this material, if it is necessary and profitable, can be supplied much more economically from some other source of supply.

"Is it advisable to house cows closely during the winter?"

If it was possible to secure, in the average barn, good ventilation without cold air then we would say by all means keep them closely housed, but under the conditions as we find them the indications are that it is possible to carry the idea of substituting pine boards and stone walls for feed too far, and that there is a point beyond which this theory cannot be carried with profit and without injury to health.

On the other hand, a little observation will show any one that cows cannot be turned out into cold zero weather without a positive loss of milk and butter. The feed is first used for sustaining the

necessary heat of the system and the remainder goes for the manufacture of milk and butter.

It has also been clearly proven that while want of ventilation will not cause or create tuberculosis, yet it is quite as positively proven that want of ventilation will increase the rapidity of its spread through the herd.

"How is the butter-fat in milk produced and affected by food?"

It is quite common to suppose that the supply of butter-fat in milk is dependent upon the amount of fatty material in the food, and that foods rich in oils furnish milk rich in fat; in fact, this view was until quite recently generally accepted by even our best authorities. In Bulletin No. 92, of the Cornell Experiment Station, Prof. Wing thus alludes to this belief: "It is the common opinion among dairymen that food exerts a great influence upon the quality of milk, although experiments have long since shown that, in most cases, the quality of the milk is dependent upon the individuality of the cow, and is very little affected by the food. The first experiments leading to these conclusions were made in Germany, but several of the American Experiment Stations have confirmed the results of the foreign experiments."

The authority quoted, in alluding to an experiment by Prof. Wood, of the New Hampshire Station, gives the following as the condensed result of an experiment in which, in addition to the usual ration of ensilage and hay, the animals were fed for two weeks on rations containing cotton-seed oil, palm oil, cocoanut oil, and also oleomargarine oils:

"The first effect of an increase of fat in the cow's rations was to increase the per cent. of fat in the milk.

"That with the continuance of such a ration, the tendency was for the milk to return to its normal condition.

"That the increase in fat is not due to the oils, but to the unnatural character of the ration.

"That the result of feeding oils tend to confirm the conclusions that the composition of a cow's milk is determined by the individuality of the cow, and that although an unusual food may disturb for a time the composition of the milk, its effect is not continuous.

"After adding from four to five pounds of several leading foods containing large amounts of fat to the daily ration, Juretscke concluded that 'milk secretion is not directly, but only indirectly affected by the feeding, and that the feeding of large amounts of fat does not increase the amount of butter-fat in milk.'"

Spier writes: "The proportion of butter-fat is very little influenced by foods containing a large percentage of oil, such as linseed or cotton cake, nor yet by albuminous food, such as pea meal, decorticated cotton cake, etc."

Prof. Wing thus describes the manner of conducting the Cornell experiment:

"The cows were at pasture and were receiving a grain ration of eight pounds per day of an equal mixture of wheat bran and cotton seed meal. This they continued to receive. During the first week, from September 14th to 21st, no change was made in the ration. The fat was determined in each milking separately by the Babcock test. At the conclusion of the first week, four ounces of tallow per day were added to the grain ration, night and morning. The cows ate the tallow readily and as fast as seemed best, the amount of tallow was increased, four ounces at a time, until all of the cows were eating two pounds each per day. This occurred during the fourth week with all of the cows except Pet, who seemed to be less fond of the tallow than the others, and did not eat the full ration until the fifth week. The experiment was then continued until the end of the tenth week, when the tallow was discontinued and the milk weighed and fat determinations made for two weeks longer.

"For the first six weeks after beginning to feed the tallow, separate determinations of the fat were made for each cow for each milking. From the seventh week on, samples were taken from each milking for each cow separately, and a composite test of the same made each week."

As the result of this and a similar experiment made by him, Prof. Wing arrives at the following conclusions:

"In this quite extended trial, there has been no increase in the milk ration by feeding tallow to the cows, in addition to a liberal grain ration. These results are obtained with ten different cows, of two breeds, of various ages, in various periods of lactation, extending over a period of ten weeks, for at least six of which they ate two pounds of tallow per day."

"How much water should there be in butter?"

There is no law upon the statute books of our State which fixes the minimum of water which may legally exist in butter, and we presume that in case of a law suit, expert evidence would be taken to fix this minimum. We believe that English law fixes a minimum of 14 per cent. of water, but it is also stated by good authorities that it is impossible to convict upon less than 16 to 18 per cent., and in some localities with less than 20 per cent.

A short time ago complaints came to the Department of Agriculture that "American" butter sold in Europe contained too much brine for the English market; this complaint led to an investigation, and the following table shows the result of several analyses of "American" and English butter, showing the butter fat as well as the water:

	Per Cent. Water.	Per Cent. Butter-fat.
Minnesota creamery, ...	11.47	86.63
English Dorset, ...	15.00	83.69
Brittany rolls, ...	15.36	83.70
Irish creamery, ...	14.63	79.54
Kansas creamery, ...	8.34	90.43
Kansas creamery, No. 2, ...	8.95	89.05

An English authority gives the following as the usual ranges of English butter:

Water, ...	8 to 14 per cent.
Fat, ...	80 to 88 per cent.
Curd (casein), ...	0.5 to 3 per cent.
Salt, ...	0.5 to 5 per cent.

Dr. Bell writes: "A greater amount of water than 12 per cent. is unnecessary so far as attaining a good appearance is concerned, and anything over 16 per cent. is injurious to the keeping qualities of the butter." Robinson & Cribb state that "certain substances are said to be added to butter to facilitate the incorporation of very large quantities of water; rennet, and, in America, a mixture of sodium sulphate and pepsin has been used. As much as 40 per cent. of water, it is said, has been added to the butter without its presence becoming noticeable to the ordinary observer."

"Is there no simple and inexpensive plan by which oleomargarine can be detected?"

Not with sufficient certainty to go before a jury, in a case against a manufacturer or seller of oleomargarine. But it is claimed by one or more of the special agents of the Department that they have inexpensive tests by which they can, in a majority of cases, tell whether the sample is oleo or not.

In France, Mons. Elvire, an inspector of food products, gives the following rules:

"1. Melt the butter to 95 degrees Fahrenheit; if it is pure the liquid is perfectly clear; if it is mixed and much more cloudy, it contains margarine.

"2. Filter the melted butter through a piece of flannel. If the butter is pure it passes through like water through a filter; if it is mixed it is much harder to pass through and falls drop by drop.

"3. To the product thus filtered add a solution of nitrate of silver; shake it and plunge the tube in boiling water. If it is pure the mixture remains as it is; if a fraud it becomes a marine color, which, according to the quantity of margarine contained in it, turns the color of beer or coffee. This reaction discloses the presence of vegetable oil, margarine being composed of oleomargarine or an extract of animal fat, milk and vegetable oil.

"4. Finally, the oleomargarine is tried by the aid of an instrument called an oleo-grammetre. This instrument is composed essentially of a metallic stem, which is placed in the melted butter, to which has been added a little sulphuric acid. It is then left to get cool for an hour, until it is at 71 degrees Fahrenheit. If the butter is pure, the tube will sink by reason of its own weight to the bottom of the vessel; if it is not pure, the tube will not sink."

"What is the cost of milk?"

It depends upon at least three factors, the man, the cow and the feed; and error in any one of these may and will very materially increase the cost of the milk. The man, by improper management or feeding may double or halve the cost of the milk. Improper food may double its cost; poor cows may and often do more than double the cost of their product.

A large milk producer in New York writes thus:

"The poorest cow that I ever owned gave 1,000 quarts a year at a cost of over five cents, while another cow produced over 7,000 quarts at a cost of less than three-fourths of a cent a quart.

"A year ago the food cost per cow per day was 26.15 cents. Of this the farm furnished 8 cents and 18.15 cents was purchased. On this expense, the herd averaged 14 quarts a day, at a cost of 1.86 cents per quart. The ration was 12 pounds of hay, 8 pounds of corn fodder, 10 pounds of wheat bran, 6 pounds of hominy and 3 pounds of cotton-seed meal.

"An effort was made to reduce the cost by better study of the feeding question, and the following ration was adopted: 20 pounds of hay, 3 pounds of oats straw, 3 pounds of oats, 6 pounds of wheat bran, 4 pounds of buckwheat middlings and 2 pounds of cotton-seed meal. This ration cost 21½ cents per day. Of this 10 cents was raised on the farm and 11 cents purchased. The milk increased to 15.14 quarts per day, making the cost per quart 1.4, a saving of over three-quarters of a cent per quart per day. In 1895 my cows averaged 1,000 quarts

per cow and the milk cost me 2.8 cents per quart. Last year the yield was 3,754 quarts per cow. This result was brought about by weeding out the poor cows and putting good ones in their places. To know the good from the bad, the milk of each cow was weighed and tested at regular intervals. 'I guess so' was discharged and 'I know so' put in his place."

Ex-Governor Hoard, in an address at an agricultural meeting, spoke thus: "There are 800 patrons of the Hoard creameries. Among them, at each of the ten creameries are men who produce milk at 50 to 75 per cent. less cost than the others. Every penny of reduced cost means that much increased profit. Yet it is hard to get these unsuccessful ones to study. In these times of low prices they are groaning with financial colic, yet no man can get them to see where the waste is."

"What is the yield of butter per cow in a first class dairy, and what is the cost of the milk?"

We can probably give no better answer to this question than to quote the following from our own writing in the annual report of the State Board of Agriculture for 1893. The extract is from that portion of the report relating to an extended experiment with cows at the Cornell Experiment Station, under the care of Prof. Wing, and is as follows:

"It will be noted that the production of each cow is stated in 'butter fat' pounds and not in butter, as ready for the market. Assuming that average butter contains 20 per cent. of water, salt and other matter not butter fat, we may conclude that the average yield of the herd was equal to 357 pounds per cow, but it is not safe to assume that, in the ordinary dairy practice, we can obtain all of the butter fat from the milk; but assuming that one-half of one per cent. of the butter fat will be lost in the milk and butter milk, we have 332 pounds left as the annual average product per year of each cow. From the table it appears that the best cow gave 439 pounds of butter fat which, upon the same basis as is used in the calculations above, is equal to nearly 550 pounds of marketable butter.

"It will also be noted from the table that while, on an average, the largest yield of milk produced the largest yield of butter, yet the cow which gave the largest weight of milk (11,165 pounds) did not make the largest weight of butter fat, which is credited to a cow producing but 10,754 pounds of milk.

"In this connection it may be interesting to note that the average live weight of the cows is 1,138 pounds and their average product of milk is 7,240.5 pounds or at the rate of trifle more than six and one-third times the weight of the average cow.

"From this table the following are, by calculation, obtained: Average cost of food was $45.25; the highest cost per cow was $53.38, and the lowest was $36.24; the average cost of the milk was 62.5 cents; the highest cost per 100 pounds being $1.48 and the lowest 44 cents. Putting the value of the milk at $1.00 per 100 pounds at the barn, we find that all of the cows but two were producing it at a profit and, valuing the butter at 25 cents per pound (or the butter fat at 30 cents), all the cows were more than earning their keep in the butter product alone."

"Is first-class creamery butter shipped to England to any great extent?"

The most of the first class butter imported into England comes from the northern part of France and is without salt; any butter which is to displace this must comply with the same requirements and be made without the addition of any salt.

Several shipments have been made, but thus far the results have not been such as will warrant any great extension of the trade. One lot of first class creamery shipped from New York reached the English customer in ten days after it left the churn, but the cost of packing, ice, special freight and commissions nearly or quite absorbed the profit on the transaction.

One owner of one of our western creameries shipped two tons of butter as an experiment; when the butter left the creamery it would have sold for 17 cents; it sold, to the consumer in England, for a trifle more than 21 cents.

Several shipments were made indirectly under the care of the U. S. Department of Agriculture. One of these, with the results, are thus described:

"This consisted of a lot of Minnesota creamery in 56lb boxes and tubs, and a lot of Massachusetts creamery in small tubs, family packages and fancy prints. The export was made in June. It cost about 2½ cents a pound to carry the butter from central Minnesota to London, by the single ton, with the best refrigerator accommodations all the way, except short transfers. The transportation from western Massachusetts cost rather more, because of the absence of a refrigerator car line to New York, and the necessity of paying expressage. This butter was all placed, in London, in the hands of retail dealers. They paid from 15 to 19½ cents per pound for it, the same butter being then worth 15 cents in New York. The wholesale price of Danish butter was about 20 cents in London. It was all retailed to consumers at 24, 25 and 26 cents per pound, most of it at 26. This was the same as the retail price of the best Danish, which leads the Lon-

don market for salted butter. The retailers, on being convinced of the high quality of this 'State's' butter, paid the same price for it in tubs as in the favorite 'Australian' or cubical box. Six different dealers took the Minnesota butter at a uniform price of eighteen and one-fifth cents per pound. It cost about 16 cents delivered to these dealers in London. The Massachusetts butter was of equal quality and although some of it sold to dealers at 19½ cents, the small packages were not liked. This butter was worth 20 cents for local sale in the neighborhood where made. Thus, as in other cases, the western creamery butter was sold at a fair profit, over 2 cents per pound, while the New England was sold in London at less than it would have brought at home."

"How much salt should be used for one pound of butter?"

This depends very much upon the market, some requiring double the amounts used in others. The best butter offered in the English market comes from France where salt is not used in it at all, and its use would condemn the article for the best customers.

The amount also depends upon the stage in the manufacture of the butter in which it is applied. An amount which is proper if added after the butter has been partially worked would be inadequate if added as soon as the butter is taken from the churn. An amount applied after the butter had been well washed would fail to give satisfaction if added before washing.

Philadelphia trade appears to require nearly one ounce to the pound if added after the butter is taken out of the churn, or one-half that amount if added after the butter has nearly all of the buttermilk and water worked out.

The addition of salt to butter is a question of taste, and it is manifestly the proper thing for each butter maker to ascertain what best pleases his customers and then follow that rule.

In New York there is a trade springing up for unsalted butter, and it is claimed that within a few years salted butter will be the exception of the city markets.

"Can the percentage of butter fat in a cow's milk be influenced by the character of the food?"

We may answer this question both ways and be correct; if the cow was previously fed up to her normal capacity for fat, the percentage of fat will not be increased, but the amount will be increased because the amount of milk yield will be increased. If on the other hand, the cow had not previously been fed up to her normal standard,

the percentage of fat can be increased by proper feeding until she reaches that standard, and after that will only increase in amount by the increased amount of milk given.

In order to prove this, allow a cow to fall off in the amount or richness of her feed; test her milk with a Babcock tester; again feed her up well, and again test the milk, and the result will prove the theory that under certain conditions, the amount or percentage of butter fat may be increased, and that under certain other conditions, the percentage will not be affected at all.

"Does it pay to shred cornfodder?"

The profit consists in the fact that the animals will consume more of the rough stalks than if not softened by shredding. One of our most progressive dairymen shreds all of his corn fodder and straw, and thinks that it pays him well; when threshing the shredder is set at the end of the shaker and the straw passed through it on the way to the mow. The effect is to soften the straw and make it much better for litter, and the cows will eat more or less of it when thrown into the yard.

The same dairyman also shreds all of his ensilage, and after a trial of both methods, greatly prefers the shredded ensilage to that which has been cut in the usual manner, and he reports that it does not require any more power than when cut in the old way.

"Should cows be stabled all winter?"

One of the lecturers at a New York institute, says: "For eight years our cows have gone into the stables November 1, and stayed there until April 1. They are happy, contented and are making milk, while those of my neighbors are out of doors, getting exercise and trying to get electricity out of a wire fence. They make as much milk as they do in summer, and it is worth double the price of June milk; beside they come out of the stables with their coats off and in good condition and ready for business. They have never suffered for want of exercise, and do not seem to be much worried about the weather. When Easter Sunday comes, if my wife can go to church and wear her new hat, both the cows and my wife go out; if not both stay indoors."

"Can anything be added to milk or cream to keep it from souring during warm weather?"

There are numerous preparations on the market for this purpose, but without exception, they contain materials which are injurious to health, and their use in milk or cream that is to be sold is punishable by a heavy penalty.

Nearly all of these preparations have borax or boracic acid as their foundation, and inasmuch as anything which will delay or prevent changes in milk will also prevent digestion, it follows that their use is injurious to health.

"Are sugar beets and mangels good feed for dairy cows?"

They undoubtedly are, and the question which comes up with their use is that of the comparative cost of the roots and corn, ensilage or wheat bran. Wheat bran or ensilage will usually, so far as medicinal effect goes, have the same results as the roots with the advantage that they can be produced or purchased at a less cost.

The cost of handling a large amount of roots is great, and this added to the cost of production, militates against their use as a stock food. In England, where corn and corn ensilage does not enter into competition, and where the climate is more favorable to their growth, roots are largely used and are found to be economical mainly for their laxative and medicinal effects.

"Does the law of our State make it obligatory upon the farmer to brand or mark the cheese which he may sell to his local storekeeper, or which he may take there in exchange for goods purchased?"

The law makes no exception, whatever, but requires that all cheese sold or offered for sale within the State shall have the name and address, with the quality, placed upon the top and bottom of the boxes and on two sides of the cheese in letters one inch high. The only exception to this is in the case of cheese less than one foot in diameter, where there is not room for the name and address in such large letters. In such cases, the Department of Agriculture has ruled that the name and address may be in letters not less than one-half inch long, but that the words denoting the quality of the cheese as, for instance, "full cream," must be in one-inch letters.

Primarily, the law is for the protection of the consumer; it is not intended to prohibit the use of skim-milk cheese, but its object is to enable those who want a full cream cheese to obtain it readily. Any

one, whether a farmer or more extensive manufacturer, may skim his milk as closely as he wishes, but having done so he cannot be allowed to sell the cheese as a full cream cheese, but must brand it so that its true character and value may be known; and the retailer who sells, or offers for sale, a cheese which is not properly marked or which is below its stamp in actual fat contents, is equally liable, and the manufacturer, if he resides within the State, will be punished with the retailer.

If, therefore, a farmer or dairyman sells cheese to any one, either a neighbor or his local storekeeper, he should, if he wishes to avoid possible trouble, be careful to strictly comply with the law in marking the boxes (if any are used) and the cheese; a failure to comply may subject him to a heavy penalty which is shared by the local dealer who offers the cheese for sale, either whole or cut.

"Is there any special benefit derived from feeding green or immature rye or corn?"

The benefit, if any, has been greatly overestimated and the possible medicinal benefit confounded with that affecting food values only.

Until a stalk of rye comes out in head or a stalk of corn in tassel, it contains little or no real food value, but after it has passed this point, its character changes and from that onward, takes up increasing amounts of plant food, becoming correspondingly more valuable as stock food.

After either have passed a certain point, all of their food value is above ground and the saving of it becomes merely a question of cost; thus, when corn is ready for the silo, it may be taken in and thus preserved; if it had remained out longer and been husked, no food value would have increased but the food which was in the stalk in the ensilage would have simply passed upward and forward into the ear, and considered as one, the stalk and ear would have contained the same food value as they did when cut for the silo.

The contest between the two plans (the silo and husking), therefore, resolves itself into the one of cost of the preservation, and in this respect, within certain limits, the indications are that the silo has the advantage.

We have fed green corn to cows and, after eating large amounts, have had them bawl, apparently for something else to eat. The indications were that, in its excessively green state, it did not contain sufficient food value to enable them to get enough into their digestive organs to satisfy hunger, but after the tassel or smaller ears had formed, this was all changed, and the effect was visible not only in the animals themselves, but also in the milk pail.

Until the plant begins to take steps towards the formation and perfection of its seed, much of its subsequent food value has not left the ground, and if the crop is fed in this state it is lost to the stock and their owners. But after it has passed this point and has begun to store up plant food for the formation of its seed, its character changes and it furnishes more and more food value as it approaches maturity.

"Has the practice of cooking feed for stock proven profitable?"

Not as a rule; in many, and in fact most cases, it has been abandoned after a brief trial, or as one of my neighbors put it a few years ago, "it is only profitable where there are ample funds to back it and where those who practice it do not have to pay either interest or rent."

The cooking makes a certain proportion of the food available which would have otherwise gone to the manure pile, and to the stock farmer who studies economy, it is merely a question of dollars and cents. If the amount of food thus utilized or saved is worth more than the cost of the operation, it has paid; otherwise it is unprofitable unless there is some other source of profit as, for instance, the benefit derived from warm food as compared with cold or uncooked.

The action of cooking is to break up the starch cells of the food so that their contents can be utilized by the digestive organs of the animal. The question, then, to decide is whether it is cheaper to break up these starch cells by the action of heat, trust to the action of the gastric juices secreted by the organs of the animal, or buy the starch in the form of other or more food; the stock breeder has his choice, and there can be no room for doubt that much money has been wasted in cooking stock food, not because it did not enable the animal to get more available food from a given amount, but because this gain was obtained at too great a cost.

The same argument is true as to grinding grain. The eastern feeder criticises his western brother because he feeds his corn in the ear without grinding, and yet that brother knows by experience that the grain which he can possibly save by grinding will not pay him for the cost of taking it to the mill and the miller's toll or charges, and that it is cheaper for him to make use of more grain to reach a certain result than to attempt to save it by grinding.

It is also no doubt correct that there are stock feeders in our own State who, owing to distance from the mills and other causes, are paying too dearly for the amount of food which they save by having the grain ground for stock.

"Should grass for hay be allowed to get ripe before it is cut?"

No, for if thoroughly ripened, much of its feeding value has been changed into woody fibre and is indigestible; it should be cut at that stage of growth when it first begins to form its seed for at that time the stalk contains all the food value that it can possibly have and the longer it stands after that, the more food value is taken from the leaves and stalks and stored up in the seed to the loss of feeding value.

The very fact that all animals will more readily eat early cut hay is proof positive, even if it was not corroborated by chemical analysis and careful experiment, to show that it is most valuable when cut in that condition.

This is especially true with timothy, which after it has become ripe, contains so much woody fibre that it is but little better than wheat and rye straw and hardly as good as early cut oat straw. The same is also true but probably not to the same extent, with clover and in fact with all farm crops which are used for provender or coarse feed.

"Which is the best feed, cotton seed or linseed meal?"

The comparative value of the two will depend somewhat on their prices; they produce opposite effects upon the butter; cottonseed meal will make butter hard and brittle while linseed meal has the opposite effect. In the South where they feed large amounts of cottonseed, notably in the neighborhood of Atlanta, the butter is as brittle as thoroughly cooked tallow, and breaks under the knife in the same manner.

One is constipating in its effect and the other laxative, and neither should be fed in large amounts but should always be fed in connection with ensilage or grain. In all cases when first used they should be fed very moderately at first or they may cause derangements of the digestive organs which will destroy all the profit that otherwise might have resulted from the feed.

"What can be done to prevent animals from being annoyed by the Horn Fly?"

Probably the best plan is to apply a mixture of kerosene oil and fish oil between the horns and at points at which flies gather together and cannot be reached by the tail of the cow. One application every three or four days will do much to mitigate the evil and

cause little or no inconvenience to the animal. Any kind of stiff grease to which kerosene oil has been added will answer the purpose, and if well rubbed into the hair, near the base of the horns, need not be put on in very large amounts. Some advise that pepper should be mixed with it but it is difficult to understand from a knowledge of the habits of the fly, that this can greatly improve the application.

"Is there any rule for feeding grain to milk cows?"

Much depends upon the character of the grain and a rule which would apply to corn meal would not be applicable to oats or wheat bran. A rough rule is to feed one pound of grain to each one hundred pounds of the weight of the animal. For the best butter, cows are fed on equal parts of corn and oats ground together the relative proportions depending upon the season of the year the amount of corn being largest during cold weather and least as the temperature rises.

What are the comparative feeding values of ground corn and linseed meal?"

The question is a very difficult one to answer unless we know what product is to be made from the feed; in some cases one feed may be valuable for the production of milk and another for butter.

The Massachusetts report (page 153), for 1895, contains the following table of comparative commercial values of the different foods as compared with corn meal:

Corn meal (per ton),	$21 00
Wheat bran (per ton),	18 00
Gluten feeds (per ton),	23 00
Gluten meals (per ton),	28 00
Cottonseed meal (per ton),	30 50
New process linseed meal (per ton),	29 00
Old process linseed meal (per ton),	28 25

It must be remembered that these valuations are commercial, and are based upon the chemical composition of the feed without reference to the purposes for which they are fed.

The report thus explains the significance of the valuations:

"The above figures do not express the relative physiological effect of the different grains, but show rather their comparative values in

digestible protein, after figuring the digestible carbohydrates and fat in all at a definite price. They can be used as guides in purchasing."

"Might it not be profitable to use artificial heat in our cow stables?"

Possibly if the average farm stable is to be compared with the warm stable, it might, but such experiments as have been reported indicate that if the artificially warmed stable is compared with a properly constructed one, the gain will not pay for the cost of heating. The Hatch experiment station reports the following experiment which indicates the correctness of the above theory:

"This experiment was continued during the winter of 1894-5, beginning December 18th and continuing until March 8th. It will be remembered that our stable has two similar wings, one piped for hot water heating. We aimed to maintain a temperature of 55 degrees, Fahrenheit, in the warm stable. The other, of course, varied with the weather; but as both stables are thoroughly constructed, even the cold side was seldom excessively cold. Six cows were used in the experiment, three on each side. We divided the time into four periods of equal length. At the close of the first period the cows changed stables. Here they were kept for two periods, and were then changed again. In this way we equalized conditions for the two stables. Between periods, when the change in the position in the cows was made, we allowed an interval of one week that the animals might become accustomed to and under the influence of their new quarters before the records were begun.

"The apparent influence of the stables upon milk and butter fat production was small. On the average there is rather more milk and butter fat in the warm stable. The most certain effect brought out by our experiments is the lowering of the percentages of fat in the milk in the warm stable. The increased product will not nearly pay the cost of heating the stable."

"What does it cost to feed a dairy cow one year?"

Practical dairymen feed so differently that a satisfactory answer is very difficult to give; some feed all that the cow can economically consume and pay for, while others appear to think that the smallest amount that they can get along with is the most economical.

During one of the experiments at the New York experiment station, a careful account was kept of the cost of everything fed to a herd of twenty cows for each year, and a careful account was also

kept with each animal in the herd; the result is shown in the following table by Prof. Wing, the amount given being the total cost of the feed of that cow for the year:

Beauty,	$44 24
Belva,	47 65
Bertha,	42 00
Carrie,	49 07
Daisy,	41 24
Cora,	38 74
Freddie,	52 06
Gazelle,	39 96
Gem,	36 24
Glista,	46 51
Glista, 2nd,	43 80
Jennie,	42 66
May,	44 34
Mollie,	45 98
Pearl,	47 44
Pet,	43 12
Puss,	47 87
Ruby,	48 63
Shadow,	53 38
Sue,	49 08

The two extremes of cost are $53.38 and $36.24, the average being $45.25. It is presumed that the animals were fed all that they could consume profitably, and that the amount given was varied to suit each animal.

The cost of the food products used was as follows, per ton:

Hay,	$9 00
Ensilage,	1 75
Roots,	2 00
Wheat bran,	18 00
Cotton-seed meal,	25 00
Corn meal,	20 00
Corn stalks,	3 00
Cut grass,	1 75
Pasture (per week),	30

"Should milk for children be sterilized, and if so, why?"

Miss Bessie Livingston, superintendent of the Ottawa (Canada) school of cookery, thus answers this question:

"Milk forms a particularly suitable medium for the growth of the little living organisms (bacteria) which are so frequently the source of infection and disease. No dangerous organism is said to be present in the milk drawn from a perfectly healthy cow, the contamination coming from some surrounding source, either during or after the process of milking, hence the necessity for absolute cleanliness in its care. In large cities where the source of milk supply is unknown, the precaution is frequently taken to scald the milk, or can it, as we do fruit; it would be wise to adopt this plan where any doubt exists as to the purity of the milk. Sterilized milk is now commonly prescribed in the diet of young children. The milk is put into clean bottles or fruit jars, which are corked with baked cotton, and placed in a pan or pail of water. The water is raised to a temperature of about one hundred and ninety degrees and allowed to stand at that temperature an hour. The bottles are then removed and cooled as quickly as possible. Enough for one feeding only is sterilized in each bottle. By this method the milk does not reach the boiling point, and the physical condition of the milk remains unchanged. By some authorities boiled milk is considered to be indigestible."

"What is 'filled cheese?'"

Filled cheese is made from milk from which more or less of the cream has been removed and some other fatty material substituted; the usual substitute for the cream is "neutral lard," or material prepared somewhat in the same way as oleomargarine for butter; this, in a melted form, is added and the cheese made up in the usual manner. The proportions used vary greatly, but usually, if used at all, the substitutes are used to a large extent and the cheese practically becomes an oleo cheese.

Under the National law, a government tax of one cent per pound is levied upon all "filled cheese" manufactured, and all manufacturers and retailers must take out a special United States license, which varies in accordance with the amount made.

The United States law took effect September 6, 1896, and from that date until the end of the fiscal year, June 30, 1897, there were, according to United States Government records, 1,663,067 pounds made, which paid a tax of $16,630.00 into the United States Treasury.

Seven factories paid a government tax of $400.00 per annum, and one wholesale establishment, in Maryland, paid a tax of $250.00.

Sixty-two retail establishments were reported and paid a special United States tax of $12.00 each, or a total of $744.00; of these, four were in Illinois, three in Indiana, twenty-nine in Louisiana, nineteen in Maryland, two in Missouri, two in New Jersey, two in Virginia and one in West Virginia. No "filled cheese" was withdrawn for exportation during the period above mentioned.

The laws of Pennsylvania forbid the manufacture or sale of "filled cheese" under heavy penalties, and the Department of Agriculture had, for a considerable time, watchmen looking after a large lot in cold storage in Pittsburgh. It was claimed that the lot was in storage in transit to West Virginia, and this eventually proved to be the case, or at least it was taken out of the State.

Prof. Wiley thus describes the manufacture of "filled" cheese:

"An emulsion of lard is made by bringing together in a disintegrator lard and skimmed milk, both previously heated to 140 Fahr., in steam jacketed tanks; the disintegrator consists of the cylinder revolving within a cylindrical shell; the surface of the cylinder is covered with fine serrated projections, each one of which is a tooth with a sharp point; as this cylinder revolves rapidly within its shell the mixture of melted lard and hot skimmed milk is forced up in the narrow interspace and the lard becomes very finely divided and most intimately mixed or emulsioned with the milk. This emulsion consists of from one to three parts of milk to one of lard; it can be made at one factory and taken to another to be used for cheese, but it is usually run at once into the cheese vat.

"In making the cheese a quantity of this emulsion, containing about 80 pounds of lard, is added to 6,000 of skimmed milk, and about 600 pounds of butter milk in the cheese vat and the lard that does not remain incorporated with the milk or curd (usually about 10 pounds), is carefully skimmed off. These quantities of materials yield about 500 to 600 pounds of cheese containing about 70 pounds of lard or about 14 per cent. About one-half of the fat removed in the skimming is replaced by lard."

"What is the best breed of cows for the dairy?"

This is a very difficult question to answer, because dairy qualities are scarcely a matter of breeds, but is too often a question of individual cows. It is also difficult to answer, because we are not informed as to the character of the dairy. It is evident that, admitting that a fair comparison of breeds can be made, the selection must necessarily depend upon whether the object be butter or milk.

We cannot devise any possible way in which such a test could be fairly made, as, in order to make it conclusive, the question of in-

dividuality must be eliminated entirely. No doubt we might select a dairy of the individuals of each breed which would fulfill most, if not all, of the requirements of a dairy, and that it would be equally possible to select one from each breed which would fail to fulfill the first requirements of a dairy, that of profit.

Prof. Wing, of Cornell Experiment Station, in addition to the large number of practical experiments which he has made public, has recently given us a partial one showing, so far as the Station herd is concerned, a comparison between the Short-horn, Jerseys, and Holsteins, and the results of this test have been condensed into the following table:

	Cost of food consumed.	Pounds of milk given.	Pounds of fat produced.	Cost of 100 pounds of milk.	Cost of one pound of fat.
Two grade Short Horns,	$51 23	9,705	411.07	$0 53	$0 125
Seven grade Jerseys,	40 87	5,237	269.67	78	15
Eleven grade Holsteins,	46 95	8,067	272.96	58	17
Average of all,	$45 25	7,241	285.62	$0 625	$0 158

In commenting upon the results shown by this experiment, Prof. Wing writes as follows:

"As between the Jerseys and Holsteins, the Jerseys were kept at a cost of about 6.00 per year, or thirteen per cent. less; they gave a little more than five-eighths as much milk and almost as much fat as the Holsteins; and produced fat at a cost of two cents per pound less, and milk at twenty cents per hundred weight more than the Holsteins. The two grade Short-horns ate the most food, gave the most milk and fat, and produced milk and fat at the lowest cost, but for the reasons already shown, they cannot be considered as types of the common grade cows of the country; they simply illustrated the fact that has often already been noticed, that among such cows are to be found here and there individuals that will respond to good care and improved feeding, in a most remarkable way."

"*Is salicylic acid and boric acid, now being sold for the purpose of preventing the souring of milk, injurious to health?*

Dr. Henry Leffman, chemist to the Department, writes:

"Salicylic acid in its commercial form, is a loose, colorless crystalline powder, sparingly soluble in cold water and readily soluble in alcohol. It has decided antiseptic qualities, solutions as weak as one-ten thousandth, exhibiting this property. As a preservative, it is employed in quantities varying from about one to six hundred in catsup to about one in five thousand in jellies and jams. While salicylic acid obtained from natural sources is pure, the artificial acid is liable

to be contaminated with by-products more poisonous than salicylic acid itself, and this fact must always be taken into consideration when judging of the sanitary relations of the substance. Since the natural acid sells at over ten times the cost of the artificial, it is not likely that the former will be used on the large scale. Salicylic acid is often sold under the name of "extract of salix," and under proprietary titles, such as "preservaline," for the preservation of milk, cider and similar products.

Borax is usually regarded as the sodium salt of boric acid; this is not in accordance with the views of many chemists, but the question is no important. The acid properties of boric acid are feeble and need not be taken into consideration in discussing its sanitary relations. It is a white crystalline powder, soluble in water and alcohol. Borax is also a white crystalline substance, soluble in water; the solution has a distinct alkaline reaction. Boric acid and borax, both alone and in mixture, have been largely used as food preservatives, especially for meat, milk and milk products. For milk, it appears that the mixture of the two is better than either alone. Boric acid and borax are mineral substances liable to little change or alteration in the system, a fact which bears upon their suitability for use in food. Various preparations of boric acid or borax, and glycerol are now used as preservatives under the names of boroglycide or by proprietary names."

"What is the best form for the silo?"

The most economical form for the silo is that one which will enclose the greatest amount of ensilage in the least possible space, and require the least possible amount of material in its construction. It is evident that a perfect circle comes the nearest to complying with these conditions, and, from the fact that there are no corners to mould, the circle is undoubtedly the most economical form for the silo.

S. F. Barber, near Harrisburg, has one of the most economical round silos that we have yet seen; on a circular foundation, within a square building, he erected studding and temporarily braced them from the sides of the square, outer building or shelter; in order to secure the requisite heighth, the studding were spliced at different heighths; boards six inches wide and one inch thick, were split into half inch thick; the course was bent to follow the course of the circle and securely nailed to the studs, care being, of course, taken to splice the siding upon the different studs. A layer of tar paper was then put on all around, and on the top of this another layer of the half inch boards nailed on in the same manner as the first

course; this gives two courses of boards, with tar paper secured between them.

Inasmuch as the pressure is the same all around, there is little or no tendency to spring outward, and the equal pressure balances all around. In filling, there are no corners to require attention and give their quota of mouldy ensilage; but little care need be exercised in filling, and taking cost and efficiency into consideration, we think this silo meets all requirements.

"Is the Babcock test sufficiently accurate in testing the amounts of butter-fat in milk?"

We unhesitatingly answer "yes," if properly made. Nine-tenths of the erroneous tests by this method are not due to the test itself, but to the operator. The Connecticut Experiment Station report gives the record of fifty tests made by both the Babcock and "gravimetric" methods, and draws the following inference from a comparison of the two plans:

"In thirty-six per cent. of the tests, the variation from the standard ('gravimetric') method was not more than one-tenth of one per cent.

"In seventy per cent. of the tests, the variation from the standard method was not more than a quarter of one per cent.

"In eighty-six per cent. of the tests, the variation from the standard method was not more than one-third of one per cent.

"In ninety-eight per cent. of the tests, the variation from the standard method was not more than a half per cent."

The average result of the tests of fifty samples of the cream, by the gravimetric test, was .20146 per cent., and of the fifty tests of the same samples by the Babcock test, the average was exactly the same as by the former method.

In twenty-six of these tests, the gravimetric method gave a higher result than the Babcock test, and in twenty-four cases the Babcock test gave the highest results.

When we remember that the gravimetric test was an absolute one, it is evident that in the hands of those who thoroughly understand its use, the Babcock test is perfectly fair and safe; and from the evidence obtained by the Connecticut Station, it is evident that in a large majority of the cases in which this test has been condemned, the trouble has been due to the manner of selecting the samples, and not to the test itself. In very many cases the sample is drawn from the surface after the milk has remained quiet in the pail for some time, and, as a natural consequence, the result was

above a fair average of the bucketful of milk, the richer portions having risen to the surface.

With properly drawn samples, and in the hands of a careful operator, it is a safe test to either buy or sell by, and has the advantage of being inexpensive.

"Does it pay to raise cows in this State?"

An answer to this question involves items which are too often lost sight of; it is not so much a question of the actual cost of producing the cow as it is of her value when she has been produced. It may be possible, and no doubt is the fact, that cows raised in our State cost more than the average cow produced in the West and brought here; but is it not also almost as certain that she is of more actual value to the dairyman?

We admit that cost is, and should be a governing factor, but we must at the same time not lose sight of the average, actual value of the production; on low priced land and with low priced grain and provender, it is possible to produce cows at a rate considerably below the estimates of conservative stock raisers in this State; but it is possible, and by many claimed to be positive, that the average home-raised cow is more valuable as a dairy machine than the average purchased cow; if this difference in value is sufficiently large, it may more than counter-balance the increased cost, and hence, value, rather than cost, is the governing factor.

In 1882 (see annual report of 1882, page 48), the official correspondents of the Board were furnished with the proper data upon which to base estimates and requested to inform the Secretary of the Board of Agriculture as to the cost, in their locality, of raising the leading kinds of live stock, and among them dairy cows; the average of the reports from a large number of correspondents in each of the 67 counties of the State gave $33.95 as the cost of a cow at three years old. The reports varied considerably, and as an illustration, we give the following:

First year:

Calf, two weeks old,	$2 00
Chop feed and milk,	8 00
Hay and grass,	6 00
Care,	2 00
Cost at one year old,	$18 00

Second year:

Pasture,	$6 00
Chop and feed,	5 00
Hay,	6 00
Care,	2 00
Cost at two years old,	$37 00

Third year:

Pasture,	$9 00
Hay,	7 00
Chop and feed,	14 00
Cost at three years old,	$67 00

One defect in this estimate, and one which raises the cost of the animal considerably, is that she is charged with the whole cost of feed for the third year; by the middle of the third year she would probably have been "in profit" and in condition to have paid for her feed, possibly for the whole year; if this view is taken, it follows that the estimate of this correspondent is not very far from the average, for if the cost of the last year's keep is supposed to have been paid for by the calf and milk, it reduces the estimate to $36.00, or about $3.00 above the average of all estimates.

Another correspondent, who claims that after the second year the animal should be giving milk and pay for her keep, gives the following estimates:

First year:

Milk and meal,	$5 52
Pasture,	2 50
Hay, fodder, etc.,	5 20
Cost at one year old,	$13 22

Second year:

Corn, bran, etc.,	$4 14
Pasture,	3 00
Hay,	5 00
Fodder, etc.,	2 40
Cost at two years old,	$27 76

One defect to be noted in this estimate is that it makes no allowance for the value of the calf when taken from the cow to be fed on milk and meal.

The Missouri Experiment Station (Bulletin No. 28), gives the following conclusions, taken from the result of one of their extensive and careful feeding experiments:

"1. That the cost of raising calves, say during the first year of their lives, is less than that of a later period. That, consequently, the cost of production calculated for the whole of their lives is less than that of the latter period alone.

"2. That the cost of the feed has been given at market prices, allowing a profit to one or two middle men, which the farmer who produces it should retain for himself.

"3. That the manure produced by the animals has not been given any value at all; in reality, it is a most important element in farm economy, and worth a good many dollars, even on fertile western lands."

"What are the claims in favor of ensilage?"

In many cases there is more claimed for this class of food than is warranted; many of its friends appear to have an idea that in going through the silo, in some unexplained manner, it adds greatly to its value.

The main claim is that it furnishes the animals during the winter with a food which more nearly resembles the green grass in summer pasture, and which, by its medicinal properties, adds to its food value, and in this way exceeds the feeding value of the same crop in any other form. After corn has reached a certain stage of its growth, its strength may be said to all be above ground; that it, its feeding value is either in the ear or in the stalk and leaves; after it reaches this stage, that plan which preserves the greatest percentage of its food value is certainly the most economical. If it was possible to save all of this value by cutting and husking in the usual manner, ensilage would lose one of its greatest claims to public favor; but the fact is, that after the crop has passed a certain stage, the material which would otherwise have been digestible, is changed into indigestible or woody fibre, and is practically lost to the feeder. The silo comes in at this point, and enables us to save the whole feeding value of the crop, and in addition to this, it, as before stated, gives us a change of food most nearly resembling summer pasture.

With our present knowledge, there is probably no known plan by which so large a percentage of the actual food value of the crop

can be utilized than through the medium of the silo, and certainly no plan combines more good features for a given amount of expense.

"What is the cause of 'ropy milk?'"

The condition of milk known as "ropy," has been attributed to numerous causes, and many of our practical dairymen disagree greatly in their theories as to its origin. Numerous cases have been brought to the notice of the officers of the Board of Agriculture, and many of them have been carefully investigated. In one case the trouble suddenly appears among a large herd of over one hundred cows; various causes were assigned; the veterinarian of the Board was sent to investigate, and after carefully examining all of the surroundings, suggested that it possibly was due to the fact that the cows, although good water was plentiful, had access to the discharge of a sewer from a large school building. The outlet of the sewer was fenced up, and the trouble ceased.

Several of the cases were readily traced to the use of improper food, or to the fact that the cows had access to impure or stagnant water; in one case it was apparently fully proven that but one cow in a dairy of fifteen was in the habit of drinking the impure water; evidently this was sufficient to contaminate and spoil the milk of the entire herd.

The fact that numerous cases had been traced to the use of impure water, and that the prohibition of this source of contamination remedied the evil, led to the belief that the trouble was due to the growth of some species of ferment or bacteria, and this, after the investigations of Prof. Conn, appears to be the most plausible theory; in referring to it, Bulletin No. 29, of the U. S. Department of Agriculture, has the following:

"There has been the greatest variety of theories as to the cause of slimy milk; diseases of the mammary glands, variations in the food of the cow, and differences in conditions surrounding the dairy have all come in for a share in the explanation. But the slimy fermentation of milk has been found to be connected with a large variety of organisms; some of them give to the milk only a slight sliminess, while others render it tenacious almost beyond belief. One described by Conn renders milk so slimy that it can be drawn into threads ten feet long, and so small as to be hardly visible. Some of the organisms render milk slimy in their early growth, others only after several days, and some do not render the fresh milk slimy at all, but first curdle it, and then dissolve the curd into slimy solution."

"What is the cause and what the proper remedy, for abortion among dairy stock?"

Prof. R. S. Huidekoper, when veterinary surgeon of the Board, answered a similar question as follows:

"I think that abortion in cattle is too generally supposed to proceed from but one cause. There are at least two distinct classes of abortion, the one sporadic and the other of the contagious form. For instance, in one case the cattle are moved to another farm, have a violent change of food, are over-fattened, are fed too strongly with food of an oily nature, are forced into constant change of food, and thus produce a number of abortions, incidentally.

"Beside this we have another class of abortions, which are doubtless contagious in their nature. A cow comes on a farm and aborts, and that abortion extends to other cows hitherto free from it, and perhaps it will remain on that farm for years.

"The peculiarity of this form of abortion is that cows aborting for the first time are early in pregnancy, and, after the farm and buildings have been infected by a new cow, in several years they will carry their calves until nearer their natural time, each year a few months longer, and finally they carry to the full, natural time and abortions cease in that dairy.

"The handling and treatment of aborting cows must be varied, as the cause comes from over-feeding or contagion, and the same rules of treatment cannot be applied to both forms. In all cases of abortion, the foetus, as it is delivered, should immediately be carried off, and either buried or burned, and the stalls thoroughly washed, and the cow moved away from other animals.

"Assuming that it may be a case of contagious abortion, the only treatment that has ever been effectual is the treatment by tar water, and the internal use of balls of tar and hyper-sulphate of soda, fed to the cows every second day, especially during the first few months of pregnancy; this is perhaps the only treatment which has proved effectual. Next to this, the thorough cleaning of the stables, racks, etc.

"I have just returned from a farm on which a large number of abortions have occurred during the past three years. Just at the time I was called on, there had been a new barn finished, and the cows were ready for removal to it. I expected that the change to the new barn would free them entirely from the trouble, but, as the owner wanted them treated, I gave them the ordinary treatment. The contagion was stopped, but I do not think that the treatment had much to do with it; the movement had destroyed, by removing it, the effects of the contagion.

"In very precocious cattle that are forced, and in inbred cattle,

there is a much greater tendency to abortion; then, too, the habit of keeping them in close and warm stables has the same effect—that of rendering them prococious and more subject to abortion. I do not think that feeding them with warm or steamed food would be an immediate cause of abortion; at least not beyond the fact that steamed food forces the animals to either fat or to milk and produces looseness of the tissue, which is not in any case advantageous to the future health or reproductive powers of the animal; exercise and ordinary care are much safer for growing and breeding animals. Simply regarding the cow as a mere machine for making milk, warm or hot feed is the proper kind; but for the reproduction of the race, and for general health, it is injurious."

"Will it pay to aerate milk? Will not cooling down to a given temperature accomplish the same or similar results without aeration?"

Practical experiments appear to clearly prove that many, if not all, of the benefits which have heretofore been claimed for aeration, were really due to the cooling which has heretofore always accompanied it, and that cooling to the same degree, without aeration, will accomplish substantially the same results.

Profs. Plumb, at Perdue, and Wing, at Cornell, have proven by careful experiments, that a lot of milk divided and one-half aerated, gives the same amount of butter in both cases, and that, therefore, aeration is labor lost. Prof. Plumb set two similar lots of milk; one was aerated to a temperature of 56 degrees, and the other was set away as drawn; both were kept at a temperature of 55 degrees, and there was no difference in the amount of butter produced, and no difference in the amount of butter fat left in the skim milk.

Prof. Wing tested several lots of milk which had been aerated to a temperature of 40 degrees, and found that the percentage of butter fat left in the skim milk was 0.53, while that left in the skim milk from milk not aerated, but exactly similar, gave 0.31 per cent.

Prof. Cooke, of the Vermont Station, gives the following tabulated results of several tests in the same direction:

Number of Test.	Milk Not Aerated.		Aerated and Cooled.		Aerated Without Cooling.	
	Temperature when set.	Per cent. of fat in skim milk.	Temperature when set.	Per cent. of fat in skim milk.	Temperature when set.	Per cent. of fat in skim milk.
1,.....	95°	0.35	46°	0.70	95°	0.35
2,.....	94	0.35	46	0.50	95	0.50
3,.....	96	0.35	46	0.45	96	0.35
4,.....	95	0.35	48	0.60	95	0.40
5,.....	95	0.50	50	0.60	95	0.45
6,.....	98	0.50	52	0.60	98	0.50
7,.....	98	0.30	52	0.50	98	0.30
Average,.	96	0.39	49	0.56	96	0.41

Prof. Cooke thus enumerates the advantages which are supposed to follow the aeration of milk:

"1. It is believed that aerating the milk tends to drive out any bad odors that have been absorbed by the milk.

"2. It is believed that aerating milk will have a tendency to lessen the bad taste and smell resulting from improper food, such as onions, etc.

"3. It is believed that aerating milk will cause it to produce more butter and cheese.

"4. It is believed that aerating milk tends to retard the raising of the cream by ordinary processes, so that more fat will be left in the skim milk.

"5. It is believed that aerating milk makes it keep longer before it sours."

Prof. Cooke admits the first and second claims, declines to discuss the correctness of the third, and, by experiment, disproves the fourth and fifth.

"What is the cost of keeping a milk cow one year?"

Farmers and dairymen vary so much in the manner in which they keep their cows, that it is very difficult to frame a definite answer to this question. They are also so careless about keeping an account of the cost of such items, that very few are prepared without considerable figuring and thought, to answer the question.

During one of Prof. Wing's recent practical experiments at the Cornell Experiment Station, a careful debit and credit account was kept with a dairy of twenty cows; this experiment showed that the total food consumed by the cows in one year amounted to the following sums:

Beauty,	$44 24	Glista, second,	$43 80
Belva,	47 65	Jennie,	42 66
Bertha,	42 00	May,	44 34
Carrie,	49 07	Mollie,	45 98
Cora,	38 74	Pearl,	47 44
Daisy,	41 24	Pet,	43 12
Freddie,	52 06	Puss,	47 87
Gazelle,	39 96	Ruby,	48 63
Gem,	36 24	Shadow,	53 38
Glista,	46 51	Sue,	49 08

In this experiment the minimum cost was $36.24, and the maximum was $53.38; the average being $45.25. In this connection it is worthy of note that the cost on the milk per quart bears little or no relation to the cost of the feed, for it was found that the milk given by the cow costing $53.38 per year for her keep, only cost the Station 56 cents per hundred pounds, while that of the cow whose feed cost $36.24 per year, cost the Station $1.07 per one hundred pounds.

In this experiment the amount of each kind of food given was regulated by the size and character of the cow; it varied from 10 to 15 pounds of hay daily; from 45 to 55 pounds of ensilage; in each case with 10 pounds of roots and 8 pounds of grain.

The cost per ton of the different kinds of feed was as follows:

Hay,	$9 00	Corn meal,	$20 00
Ensilage,	1 75	Corn stalks,	3 00
Roots,	2 00	Cut grass,	1 75
Wheat bran,	18 00	Pasture (per week),	0 30
Cotton seed meal,	25 00		

"If I can obtain 90 cents per hundred pounds for my milk at the creamery during the whole year, will it pay me to make butter at home and keep the skim milk and by-products on the farm?"

In making butter at home, so much depends upon the character of the dairyman that the question is a very difficult one to answer. If applied to the average dairyman, we would probably answer it in the affirmative, but in that case the distance from the creamery would be an important factor in determining the relative profits of the two systems.

A creamery paying 90 cents per hundred pounds for miscellaneous milk, and unprotected by any special test as to the richness of its

patrons' milk, would be compelled to work very close and to utilize all of the butter fat. We recently tested the average milk, the butter milk and skim milk of a creamery, and found that the owner was paying one dollar per hundred pounds for the milk; was using twenty-five pounds of milk to make a pound of butter, and received twenty-five cents per pound for his butter. From this it follows that his only chance for profit must have come from the water which remained in his butter, for our test was based upon a Babcock determination, which gave four per cent. of butter fat, and our calculation was based upon butter fat only.

It is well known, however, that four per cent. of butter fat will give more than four pounds of worked butter to the hundred, the difference being made up of water, buttermilk and, in some cases, salt.

If the creamery owner allows a proportionate price for rich milk, and can pay ninety cents the year round, and allow his patrons to haul their skim milk back, it will pay to sell the milk at the creamery. Some may get more out of it by making the butter at home, but the average dairyman will not usually do so.

"Is the Babcock test fair to the milk producer?"

Probably the best answer that can be given to this question, which comes to us from several institutes, is the following, from the report of the Connecticut Experiment Station:

"The average per cent. of fat in 206 samples of the milk of herds, carefully drawn at creameries in this state and analyzed at this Station, was 3.981, or, in round numbers, four per cent. That is, if this whole quantity of milk was mixed thoroughly together, 100 pounds of it would have contained four pounds of butter fat.

"But, as was expected, the milk from the individual dairies was of various quality. The milk of one herd contained 5.25 per cent. of fat, that of another 3.28 per cent. of fat, and while the percentage varied from day to day, yet the milk of certain herds was uniformly rich, while that of other herds was uniformly poor.

"These figures mean that 100 pounds of milk furnished by one patron, brought to the creamery five and one-quarter pounds of fat, but 100 pounds of the milk of his neighbor's herd brought only three and one-quarter pounds. This is an extreme case. If for illustration, we assume that the milk of A's herd contains 5 per cent. of fat, and that of B's herd three and one-half per cent., we have a difference between the herds which is not by any means extreme in Connecticut to-day.

"A an B, we will suppose, produce the same quantity of milk per week, 1,500 pounds, and are paid at the rate of $1.10 per hundred, or about 2.35 cents per quart. Their receipts are, therefore, the same, $16.50 per week. For this A furnishes the creamery with 75 pounds of butter fat, and B furnishes 52½ pounds.

"A, the patron who produces the richer milk, who has better cows, or who feeds more rationally, gets 22 cents per pound for butter fat, and B, the patron whose milk is the poorest, whose herd is poor, or who is feeding injudiciously, gets 31.4 per pound. This is a premium of 10 cents per pound for fat on thin milk, or poor stock and feeding, or on the judicious watering of milk. It presents little inducement to better the herd, or to feed for quality rather than for quantity of milk. It is obviously very unfair to all parties concerned, and bears hardest on A, who has an exceptionally good herd, or who feeds exceptionally well.

"Now, suppose this creamery changes its policy and offers, as before, $1.10 per hundred for 'standard milk' containing four per cent. of butter fat, but allows 2.75 cents per hundred for every additional 'unit,' or tenth of a per cent. of fat more than four in the milk, and deducts 2.75 cents per hundred for every 'unit,' or tenth per cent., under four.

"The two accounts will then stand as follows:

"Patron A, milk contains 5 per cent. of fat.

"Fifteen hundred pounds of milk at $1.10, ...	$16 50
"Add 10 units per hundred, or 150 units, at 2.75, ...	4 13
	$20 63

"Patron B, milk contains 3.5 per cent. of fat.

"Fifteen hundred pounds of milk at $1.10,.....	$16 50
"Deduct 5 units per hundred, or 75 units of fat, ...	2 07
	$14 43

"Under this arrangement, A has received $20.63 for his 1,500 pounds of milk, and has furnished 75 pounds of butter fat. He has, therefore, received 27½ cents per pound for his butter fat.

"B has received $14.43 for 52½ pounds of butter fat, and for each pound 27½ cents, the same that his neighbor received for a like amount of butter fat."

"Can oil-cake meal be economically substituted for corn, and if so, what are its effects upon the butter and animals?"

The practical experience of several members of the Board and of a number of essayists, clearly demonstrate that oil-cake meal can be economically substituted for corn or other grain in the manufacture of milk or butter. It has also been clearly stated by prominent dairymen at meetings of the Board, that, under certain limits, no deleterious effects are produced upon neither the milk or butter, but it has been admitted by nearly all, that if fed in too large amounts, it may injure any dairy product.

Just what the limits of economical substitution are, has apparently not been definitely determined, as speakers and essayists at institutes appear to vary much in their views. S. F. Barber, one of the most successful dairymen in Dauphin county, feeds three pounds of oil meal (in two feeds) each day to his cows with excellent results.

As to the question of economical substitution, Mr. Barber makes the following statement: "I fed 12 pounds of hay, 50 pounds of ensilage and 6 pounds of ground oats, and found the ration to cost me 14 cents per day. By feeding 25 pounds of hay, 25 pounds of ensilage, and 1½ pounds of oil meal, I had a ration costing me 22 cents per day, but the increase in milk would not pay for the increased cost of the food."

All who have tested it and have given their experience at meetings of the Board, appear to be of the opinion that the substitution of oil meal, and in fact, its use in any way, should be made very gradually, and the cows brought up to the full feed cautiously, watching each animal and noting its effects.

"How will ensilage, if deprived of its water, compare in feeding value with the same weight of corn-fodder or hay?"

This question involves so many uncertain factors that a definite answer is almost impossible. Of course, the ensilage contains no food material which did not exist in it as fodder; the fact of its having been put into a silo has not added anything to its feeding value, but has merely, as is claimed, retained all of the food value which existed when it was put in the silo. It is probably possible to so preserve dry corn fodder as to retain all the elements of food value in it, and then the question of the two methods will be merely one of comparative expense.

In referring to this question in a somewhat different form, Dr. E. L. Sturtevant writes as follows:

"When the ration has 18 pounds of an even mixture of meal and

bran, together with about 70 pounds of ensilage daily, and this compared with the same amount of grain and 30 pounds of the same fodder dried, which when put into the silo formed the ensilage, the following conclusions were justified by our results:

"That 26 pounds of fodder corn was equivalent to 70 pounds of ensilage, or 18 pounds of hay. Expressing these results in tabular form, using 100 pounds as the unit for comparison, we have: One hundred pounds of ensilage was equivalent to 38 pounds of dry fodder corn.

"One hundred pounds of ensilage was equivalent to 26 pounds of hay.

"One hundred pounds of fodder corn was equivalent to 262 pounds of ensilage.

"One hundred pounds of fodder corn was equivalent to 69 pounds of hay.

"One hundred pounds of hay was equivalent to 381 pounds of ensilage.

"One hundred pounds of hay was equivalent to 145 pounds of fodder corn."

It is very evident that in such comparisons much depends upon the relative value of the different articles of food as compared with some known standard; we all know that both hay and corn fodder are variable, owing to the comparative perfection of the preservation, and that some kinds of hay have double the value of others, and that some samples of corn fodder are worth about as much, pound for pound, as some kinds of hay which might be selected; but taking all things into consideration, we may perhaps safely adopt the figures given by Dr. Sturtevant, which it should be remembered, are the result of actual dairy practice, and not of a general analysis of the feeds, and an estimate of their results.

"What is 'cotton seed feed,' and what is its value as a milk and butter producer?"

"Cotton seed feed" is composed of ground cotton seed hulls, with a small quantity of cotton seed meal mixed with them; the feeding value of the mixture, aside from its distending effects, are probably about equal to the amount of cotton seed meal which the mixture contains. During the season of 1894, considerable amounts were sent into the dairy districts of southeastern Pennsylvania, but the results of practical experiments not proving favorable, dealers had considerable difficulty in working off the stock on hand, some even disposing of it under cost prices.

On page 49. of the annual report of the Board of Agriculture for 1894, the result of the experience of several of our practical dairymen is given, and extracts from sundry leading authorities are also given, all tending to prove the low feeding value of the compound.

In referring to a sample examined for the Board of Agriculture, Prof. H. J. Waters, of the State Experiment Station, reported as follows: "The analysis of the cotton seed feed would indicate that this particular sample contained less meal and more hulls than was claimed. A mixture of one part of meal to nine of hulls would have been about the composition of the sample examined. It should be borne in mind, however, that the cotton seed meal is a fine powder, and might very readily sift down to the bottom of the pile of feed, so that the sample as sent may not be a fair representation of the feed."

Drs. Armsby and Hess (Bulletin No. 28, of Pennsylvania Experiment Station), report as follows in relation to this feed:

"Both as regards bulk, chemical composition, and proportion of digestible matter, the cotton seed feed corresponds more nearly to a coarse fodder than to a grain feed. The results of our digestion experiments show it to contain rather less total digestible matter than either clover or timothy hay, and a little more than good corn fodder. It has, however, a somewhat larger proportion of protein than either corn fodder or timothy hay, but less than clover hay. In proportion to the amount of digestible matter which it contains, it is a relatively expensive feed, costing more per pound of digestible matter than any of the feeds named in the table, with the exception of cotton seed meal. The indications of the digestion experiments, therefore, are that the feed contains only a moderate amount of actual food, and that it is too costly to compete with more familiar feeding stuffs."

In referring to experiments with this feed at our Station, the same authorities thus refer to the use of cotton seed feed:

"A ration of cotton seed feed and bran produced 19 per cent. less milk, and 10 per cent. less butter than one of corn fodder, mixed hay, corn meal and cotton seed meal containing an equal amount of dry matter.

"The feed cost per pound of milk was 13 per cent. lower and per pound of butter, 5 per cent. lower on the hay and fodder ration, than on the cotton seed feed ration.

"The net profit per day and head was 17 per cent. less on the cotton seed feed ration than on the hay and fodder ration."

In their summary of results, Drs. Armsby and Hess write as follows:

"The result of these investigations indicate that cotton seed feed

is too expensive, in proportion to the amount of food which it contains, to successfully compete, on equal terms, with ordinary dairy foods at average prices."

"Does the addition of salt add to the weight of butter?"

With the light of recent experiments as our guide, we will be compelled to answer this question in the negative, but, at the same time, we must admit that there is still much of the old dairy theory that it does, hanging around us. All recent experiments indicate that the addition of the salt in the usual manner and in the usual amount, not only does not add to the weight of the butter, but that, at least, in some cases, it lessens the weight of the product.

Prof. Wing, of the Cornell Experiment Station, thus answers the question: "It is pretty well established among butter makers that the amount of water which butter will hold depends upon the temperature at which the butter was washed, and the fineness of the granulations. Butter that is finely granulated and washed at a rather cool temperature will hold a maximum of water, and such butter, when worked, will yield up more water if salt is added to it; that is to say, with finely granulated butter at a temperature of 36 to 40 degrees, it is impossible to work out as much water without salt as it is when salt is added, so that butter, even when worked well, weighs more without the addition of salt than with the salt. At higher temperatures there will not be so much difference, but nearly all butter will lose during the process of working, no matter how well drained it may be before being worked."

Major Campbell Brown, after a series of very careful experiments, arrives at the following conclusions:

"That if butter is worked unwashed, or washed in clean water, it will lose by salting, and the loss will average from one-half to one and one-half ounces per pound.

"That if it is washed in brine of moderate strength, it will gain by salting, seldom, however, as much as a half ounce to the pound.

"That if washed in very strong brine, it will gain in weight about the weight of the added salt, but will contain quite too much salt to be first class table butter.

"That if butter is worked, washed and salted in the usual manner, and then set aside for 12 to 14 hours, and reworked, there will be a slight loss."

The results of one of Major Brown's experiments may be thus tabulated:

No. 1.

	lbs.	oz.
Unsalted, well washed, dry butter, ...	17	.06
Salted and reworked on worker, ...	17	.03
Loss in ounces, ...	..	.03

No. 2.

Unsalted, well washed, soft butter, ...	28	.03½
Salted and reworked by hand, ...	29	.04½
Apparent gain, ...	1	.01

No. 3.

Reworked next morning, ...	26	.08½
Actual loss from unsalted butter, ...	1	.11
Actual loss from salted butter, ...	2	.12

"Does gluten meal make an economical milk producer?"

S. F. Barber, one of the leading and successful dairymen near Harrisburg, answers this question unhesitatingly in the affirmative, and proves his faith by using it by the car load in his dairy of fifty-three cows; he claims that it is profitable for him to sell corn and buy the gluten meal.

There are, however, numerous compounds which go under the somewhat general name of "gluten meal;" they may be enumerated as follows: Gluten feed, gluten meal, corn bran, corn oil meal, and corn germs, and it will be found that their value varies to a greater extent than does their price. This variation in value is mainly due to the fact that all of these products are the offal of other manufactured products, and depends greatly in character with the proportion of the corn extracted by the first product.

The New Jersey Experiment Station gives the following analysis of the whole corn, and also of its various parts, thus showing that the portion which has been taken out exercises a great influence upon the value of the "gluten meal:"

ANALYSES OF WHOLE AND SEPARATE PARTS OF CORN KERNEL.

	Amount secured from 100 parts of original corn.	Water.	Composition of the Water-Free Material.							
			Crude fat.	Crude fibre.	Crude protein.	Crude ash.	Carbohydrates.	Nitrogen.	Phosphoric acid.	Potash.
	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
Original corn, ...	100.00	24.74	4.34	2.02	12.65	1.73	79.26	2.02	0.83	0.47
Skin, ...	5.56	15.29	1.59	16.45	6.60	1.27	75.36	1.00	.23	.38
Germ, ...	10.17	29.62	29.62	2.88	21.71	11.13	48.79	3.48	6.16	2.91
Starchy and hard part,	84.27	24.66	1.54	.65	12.23	.68	85.58	1.96	.35	.17

S. F. Barber, of Dauphin county, reports his results with cotton seed feed as follows: "After three weeks' trial, I have not been able to increase the milk flow or the percentage of butter fat. During the trial they were fed one-third coarse bran, one-third corn chop and one-third cotton seed feed. On this they about held their own in milk, but lost in live weight; my usual food, costing less per cow, made more milk and more butter fat."

Prof. Voorhees, of the New Jersey Station, makes the following suggestion as a means of removing the uncertainty which now exists as to the actual character and value of these products:

"Unless some good reason exists from the manufacturers' standpoint for the separation of the various parts of the corn, general use would be promoted by making but one product, which should consist of the total residue. It would relieve the purchasers of the uncertainty as to the composition, reduce the danger liable to resulting from the careless feeding of the more highly concentrated parts of the residue, and abolish the necessity of a study of comparative values as now manufactured."

Dr. A. C. True thus sums up the composition of the various commodities:

"These materials, as classified in the bulletin (New Jersey Experiment Station, Bulletin No. 105, page 24), with the possible exception of grano gluten feed, show a wide variation in composition. For instance, the gluten meals, on an average, contained somewhat more fat and about one-half more protein than the gluten feeds, but the Chicago gluten meal contains less than half as much fat, and about sixty per cent. more protein than the gluten feeds. The Chicago maize feed, which is classed with the gluten feeds, contains about one-third less fat than the other gluten feeds. The corn germ food contains three and one-half times as much fat as the product from another factory, and sold under the name of germ meal, and corn hulls have only one-half as much fat as the corn bran."

Prof. Voorhees in the bulletin alluded to, thus refers to the variation of these products, and also to their use:

"The germ, although only about 10 per cent. of the whole kernel, contains about 65 per cent. of the fat, 61½ per cent. of the mineral matter, 71 per cent. of the phosphoric acid, 60 per cent. of the potash, and 16 1-3 per cent. of the nitrogen, or protein. The remaining portions are characterized, the skin by its content of fiber, 51 per cent. of the whole, and the starchy part by its carbohydrates, of which it contains nearly 90 per cent. of that in the whole grain."

"The residue in this manufacture may consist either of one product, a mixture of the gluten, germ, and hulls, or of three, when the gluten, germ, and hulls are each separated. The entire residue is in color, brighter yellow than corn meal, and of a much more bulky character, owing to the presence of a larger proportion of bran; the trade name of this product is gluten feed. The gluten is distinguished by a higher content of both protein and fat, and a bright yellow color, and is called gluten meal. The germ is more bulky than the meals, shows a high content of crude fat, and is called germ meal or germ food. The hulls are very bulky, show a high content of crude fibre, and are usually sold as corn bran."

"What is the proportion between 'butter fat' as shown by the Babcock testing machine, and the actual amount of merchantable butter?"

The Babcock testing machine shows the percentage of "butter fat," and not that of butter, as the term is usually understood by practical dairymen, and at institutes, during the actual testing of samples of milk, some confusion has arisen among the audience as to the point of difference as outlined by the question.

It is evident that the amount of butter (merchantable) which a given percentage of butter fat will make, depends greatly upon surroundings and circumstances; the amount of salt will have more or less influence; the amount of buttermilk left in the butter is also an important integer; the amount of water which is worked out or into the butter also exercises an effect upon the proportion of merchantable butter which may be expected.

At the meeting of the Association of American Agricultural Colleges and Experiment Stations, held at Denver, July 16th to 18th, the following was adopted:

"Resolved, That this association recommends to the several stations that the results of tests of dairy cows or herds be expressed in terms of butter fat; and that when desirable to express these records

in terms of approximate equivalent in butter, such equivalent be computed by multiplying the amount of butter fat by one and one-sixth."

The committee presenting the report upon which the resolution was based, gave, among others, the following reasons for their recommendation of the resolution:

"The Ninety Day Columbian Dairy Test is the most elaborate and carefully conducted on record. In this test 96.97 per cent. of the fat in the whole milk was saved in the butter. This butter, on the average, contained 82.37 per cent. of butter fat; in other words, 117.3 pounds of butter was made from each 100 pounds of butter fat in the whole milk. The exact conversion factor would, therefore, be 1.173. As this is an awkward number to use, and as one and one-sixth is so nearly the same (the difference in computing the record of a 14 pound cow for a week by these two factors being only .07 of a pound of butter), it has seemed best to recommend that the latter be used as the conversion factor."

"What constitutes a well-balanced ration for the production of milk?"

Surrounding conditions have very much to do with the milk producing value of any ration, and, after all, the animal exercises more or less influence upon the results. The same ration fed to cows as nearly as possible alike, and of the same weight, may produce different effects. It is not the amount of the rations fed which influence the milk production; the digestive capacity of the animal has also much to do with it.

There can be no doubt that many of our dairymen who feed in a haphazard manner without regard to balancing their rations, lose and practically waste much of the provender and grain. In an unbalanced ration, the overplus of either of the necessary constituents is not only lost to the feeder, but it is a positive loss to the animal in the unnecessary work required to get shut of it.

Another integer which is often lost sight of in compounding rations, is the varying character of the same kind of provender in different parts of our country, or, in fact, in different parts of the mow in the same barn. It is common to assign a certain number of pounds of clover hay to a ration; or a fixed amount of silage, regardless of the fact that in one case the hay may have been over-ripe, and the other in just the proper condition when cut; in these two cases, the same number of pounds would probably produce materially different results.

A few years ago, the Wisconsin Experiment Station obtained from a large number of dairymen in the state, the exact rations which they were making use of; the nutritive ratio of each was carefully calculated, and the cost of each given; as a partial result of these calculations, we may give the following sample rations: Sixteen cows; average weight 950 pounds; cows to go dry one month; ration fed: Silage, 35 pounds; marsh hay, 2 pounds; malt sprouts, 4½ pounds; bran, 2½ pounds; cotton seed meal, 1½ pounds; cob meal, 4¼ pounds; with skim milk and buttermilk; cost of ration 15.4 cents per day.

Same dairy—Ration: Silage, 35 pounds; mixed hay, 6 pounds; malt sprouts, 5 pounds; oil meal, 2½ pounds; bran, 5 pounds; corn meal, 4 pounds; cost of ration, 15.3 cents; nutritive ratio, 1:4.3.

The Wisconsin Station, after a full examination of all the reports received, publishes the following theoretical rations which may serve as a guide and answer to the question:

Corn silage, 40 pounds; clover hay, 8 pounds; wheat bran, 6 pounds; corn meal, 3 pounds; cost of ration, 14.3 cents; nutritive ratio, 1:7.4.

Fodder corn, 20 pounds; hay, 6 pounds; oats, 4 pounds; shorts, 4 pounds; corn meal, 2 pounds; cost of ration, 15.3 cents; nutritive ratio, 1:7.7.

Corn silage, 50 pounds; cornstalks, 6 pounds; oats, 6 pounds; malt sprouts, 4 pounds; corn meal, 2 pounds; cost of ration, 15.7 cents; nutritive ratio, 1:7.6.

Timothy hay, 10 pounds; clover hay, 8 pounds; wheat bran, 6 pounds; oats, 6 pounds; cost of ration, 16.5 cents; nutritive ratio, 1:6.7.

Fodder corn, 20 pounds; clover hay, 8 pounds; oats, 6 pounds; oil meal, 3 pounds; cost of ration, 16.4 cents; nutritive ratio, 1:7.

Clover silage, 30 pounds; hay, 15 pounds; wheat bran, 3 pounds; corn meal, 3 pounds; cottonseed meal, 2 pounds; cost of ration, 16.2 cents; nutritive ratio, 1:5.8.

The report after giving the scentific contents of the food of 24 herds, the rations for which are fixed by the owners without special regard to scientific feeding, gave an average ratio of 1:6.9, and hence, it would appear that the theoretical rations given by the station furnish about the same nutritive ratio as those taken for the basis of the table.

It is interesting to note that the average of all of these rations gave the following constituents: Dry matter, 25.56; digestible protein, 2.31; digestible carbo-hydrates, 13.34; digestible fat, 0.77; total digestible matter, 16.32.

Dr. H. P. Armsby, in his popular "Manual of Cattle Feeding," gives the following as a well-balanced ration for milk cows:

Digestible protein, 2.5 pounds; digestible fat, 0.4 pounds; digesti-

ble carbo-hydrates, 12.5 pounds; total dry matter, 24 pounds; nutritive ratio, 1:5.4.

This ratio is obtained by the following ration:

Twelve pounds of hay; 6 pounds of oat straw; 20 pounds of mangolds; 20 pounds of brewers' grains; 2.5 pounds cottonseed meal.

"I have five cows, none of which when tested separately, will show less than three and one-half per cent, of butter fat, and three of which will, when tested separately, show over four per cent.; and yet when their mixed milk is tested at the creamery, it shows but three and one-half per cent., and sometimes less. Why is this?"

Accepting the statement as correct, it may be accounted for on the supposition that the tests upon one side or the other are not fairly made; the owner of the animals may not have properly understood the manner of making the tests, and may have deceived himself, or, the test at the creamery may not have been honestly or fairly made.

Numerous cases may be cited to prove that the mixed milk of the dairy, especially one as small as the one stated, will always show the average of separate tests of the cows which furnished the milk, and any variation from this rule will indicate errors in testing somewhere. In many cases errors are due to the manner of selecting the samples; suppose that the five cows alluded to are all carefully milked, and the milk set aside until all have been milked, and the samples then taken without stirring the milk; the samples will, in such a case, indicate too high a percentage of butter fat, because while standing, the richer portions have risen to the top, and the sample resulting will deceive the owner; on the other hand, it is possible that the sampling at the creamery, not being in the same interest, may vary in the opposite direction.

It is claimed that there should be no variation between the tests of the individual cows of the dairy, and the mixed milk of the same cows; and that any variation that may be shown is traceable to the mode either of taking the sample, or of making the test. If the samples are all drawn in the same manner, and the tests made in exactly the same manner, with the same testing machine and exactly the same acid and re-agents, the results should be the same.

"Does fatty material in the food increase the amount of butter fat in the milk?"

All recent practical experiments, contrary to the generally accepted opinion, appear to prove that the question of the per cent. of

butter fat in the milk is, at least within certain limits, a question of individuality in the cow, or that, in other words, if the cow is a five per cent. cow, she will show five per cent. in what milk she gives, and that if the supply of proper food is cut off, she will simply give less milk, and consequently less butter fat or cream.

Two very careful experiments, under the supervision of Prof. Wing, of the Cornell Experiment Station, have led him to adopt the theory that "experiments have long since shown that, in most cases, the quantity of the milk is dependent upon the individuality of the cow, and is very little affected by the food. The first experiments leading to these conclusions were made in Germany, but several of the American experiment stations have confirmed the results of foreign experiments."

After careful experiments, Prof. Wood, of the New Hampshire Station, arrived at the conclusion that fatty matter in the food, at first increased the percentage of butter fat in the milk, but that in a short time all this gain was lost, apparently showing that the increase was rather due to what he styled "the unnatural character of the ration." The result of his experiments led him to believe that "the result of feeding oils tended to confirm the conclusion that the composition of the cow's milk is determined by the individuality of the cow, and that although an unusual food may disturb for a time the composition of the milk, its effect is not continuous."

The noted experimentor, Spier, states that "the proportion of butter fat is very little influenced by foods containing a large percentage of oil, such as linseed or cotton cake, nor yet albuminous foods, such as pea meal, decorticated cotton cake, etc."

Juretscke, another noted foreign authority, writes: "Milk secretion is not directly, but only indirectly affected by the feeding, and the feeding of large amounts of fat does not increase the amount of butter fat."

A summary of the most careful experiments will give us a negative answer, and sustain the theory at first advanced in our answer to the question, viz., that the percentage of butter fat in the milk is, to a certain extent, at least, dependent upon an inherent power to secrete it, and that it varies with different cows.

"Is wheat at present prices, an economical stock food?"

Mr. Terry, of Ohio, recommends it strongly as a feed for horses; he soaks it twelve to twenty-four hours, according to the weather; does not advise its use dry.

Prof. Allen, of the U. S. Department of Agriculture, writes thus in reference to feeding wheat:

"The experience of the last two years has furnished abundant evidence of the high value of wheat as a feed for all kinds of stock. Farmers in the west have fed it extensively and with almost universal satisfaction, financially and otherwise. It is estimated that up to November 1, 1894, upward of 46,000,000 bushels of wheat had been fed by the farmers of the United States. In Kansas alone, over 4,059,000 bushels, or 16½ per cent. of the total crop of 1893, were fed to farm animals. It has been fed satisfactorily to pigs from the weaning stage until they were fattened for the market; to colts, to work horses and trotters, to calves, to steers, to lambs and sheep, and to milch cows. It has proved itself to be the best single grain for stock, all things considered, and the cheapest at current prices. There is good reason for this, for its composition shows it to be the richest of all the cereal grains. One hundred pounds of wheat furnishes more real nutriment than a similar amount of any other grain. The reports show that 100 pounds of corn contains about 8 pounds of digestible protein, barley 8.69 pounds, oats 9.25 pounds, and rye 9.12 pounds, while 100 pounds of wheat contains 10.23 pounds of digestible protein. The amounts of digestible nutrients in a bushel of 56 pounds of corn and in one of 60 pounds of wheat are shown in the following table:

NUTRIENTS IN A BUSHEL OF CORN AND OF WHEAT.

	Dry matter.	Digestible protein.	Digestible carbohydrates.	Digestible fat.	Fuel value.
	Pounds.	Pounds.	Pounds.	Pounds.	Calories.
56 pounds of corn,	49.90	4.44	37.34	2.40	87,827
60 pounds of wheat,	53.70	6.14	41.53	1.01	92,909

"At equal prices the wheat is considerably the cheaper feed. When, as was the case, 60 pounds of wheat sold for less than 56 pounds of corn, the economy of wheat was apparent. Wheat is especially adapted to young growing animals which have muscle and bone to form, owing to its richness in protein. It also contains more ash than corn. Professor Henry places the value of wheat for growing animals at from a tenth to a quarter more than corn, and this is borne out by the above figures."

Dr. Salmon, of the Bureau of Animal Industry, in referring to the use of wheat as food for animals, writes the following:

"There are certain points to be borne in mind when one is commencing to feed wheat. Our domesticated animals are all very fond of it. Precautions should consequently be observed to prevent ac-

cidents and disease from its use. It is a matter of common observation that when full-fed horses are changed from old to new oats, they are liable to attacks of indigestion, colic and founder. If such results follow the change from old to new oats, how much more likely are they to follow a radical change, such as from oats to wheat? For this reason, wheat should, at first, be fed in small quantities. It should, when possible, be mixed with some other grain, and care taken to prevent any one animal from getting more than the quantity intended for it.

"These precautions are especially necessary when wheat is fed to horses, as these animals are peculiarly liable to colic, and other disturbances of the digestive organs, accompanied or followed by laminitis. Cattle, sheep and hogs, frequently crowd each other from the feeding troughs, in which case some individuals obtain more than their share, and may bring serious or fatal attacks of indigestion."

"What is meant by the meaning of the terms 'protein,' 'carbo-hydrates' and 'fat,' as applied to feeding materials?"

The chemical analyses of feeding stuffs, usually state five elements, viz: water, ash, fat, carbohydrates and protein. Their proportion varies greatly with different cattle foods, but in what is styled a well-balanced ration, they should exist in certain definite proportions, and the art of feeding consists in so mixing the various kinds of food which are available so that no one portion or element may be in excess; for all that exists in excess of the proper proportion, is lost, so far as its feeding value is concerned. Prof. Allen, of the National Department of Agriculture, thus defines the three elements contained in the question:

"Fat, or the materials dissolved from a feeding stuff by ether, includes, besides real fats, wax, the green coloring matter of plants, etc. For this reason the ether extract is usually designated crude fat. The fat of food is either stored up in the body as fat or burned to furnish heat and energy.

"Carbo-hydrates are usually divided into two groups, nitrogen-free extract, including starch, sugar, gums and the like, and cellulose or fiber, the essential constituent of the walls of vegetable cells. Cotton fiber and wood pulp are nearly pure cellulose. Coarse fodders, like hay and straw, contain a large proportion of fiber, while most grains contain little fiber, but are rich in starch, sugar, etc. (nitro-

gen-free extract.) The carbo-hydrates form the largest part of all vegetable foods. They are not permanently stored up as such in the animal body, but are either stored up as fat or burned in the system to produce heat and energy. They are one of the principal sources of animal fat.

"Protein (or nitrogenous materials), is the name of a group of materials containing nitrogen. All other constituents of feeding stuffs, the ash, fat and carbo-hydrates, are non-nitrogenous or free from nitrogen. Protein materials are often designated as 'flesh formers,' because they furnish the materials for the lean flesh; but they also enter largely into the composition of blood, skin, muscles, tendons, nerves, hair, horns, wool, and the casein and albumen of milk, etc. For the formation of these materials protein is absolutely indispensable. No substances free from nitrogen can be worked over into protein, or fill the place of protein. It is, then, absolutely necessary for an animal to be provided with a certain amount of protein in order to grow or maintain existence. Under certain conditions it is believed protein may be a source of fat in the body; and finally it may be burned, like the carbo-hydrates and fat, yielding heat and energy."

"What does it cost to make a pound of butter?"

We have given this question to a large number of our best and most practical dairymen, and find a great variation in their answers; by averaging the answers, we may place the cost at any point, from 10 to 19 cents per pound.

The butter which resulted from the dairy trial at the Chicago Fair cost an average of 12½ cents per pound; the Minnesota Experiment Station, after careful and economical experiments, gives the cost at 10 cents per pound. New York dairymen have placed the cost at 12 to 13 cents; three Chester county dairymen give us estimates of 14 cents per pound.

Several dairymen report the cost at four cents per pound without food, interest on cost of cows and plant being considered; others put this item of cost at 5 cents; contracts have been repeatedly made to milk, skim and manufacture the butter for four cents per pound.

"Hoard's Dairyman," in referring to the cost of butter, gives the following:

"In making a pound of butter cost 12½ cents, we have received pay for our crops at their market values, and have sold them to our cows right at home. We get cash for our crops at a market value when

we sell butter at the cost of production, and we have saved ourselves the trouble of drawing these crops to market. A man can better afford to sell butter at the cost of production than he can corn or oats or wheat, when the cost of one pound of butter includes the feed and labor at their market value, as it does in the estimates given, because he has already received his profits on his crops in the 12½ cents per pound for butter. This explains why the dairy farmer, if he understands his business, is more prosperous than his neighbor who sells his hay and grain, instead of feeding them to good cows, right at home. Did you ever stop to think that some farmers are selling their very farm, load by load, in hauling their crops to market every year, and putting nothing back on their farm?"

"What is the best cure for 'milk fever?'"

In answering this question, we may, with propriety, quote the old saying, that "prevention is better than cure;" with proper care the disease may usually be avoided. The trouble is due to the fact that the supply of blood which has heretofore gone to the nourishment of the foetus is suddenly changed into another channel; in many cases a portion of the surplus is sent to the brain, and we have certain forms of what has been styled milk fever.

The best treatment is to at once get the animal into the natural position when lying down; roll her over on her brisket, and keep her there by chaff bags, or by any similar appliance that is at hand; tie a bag of pounded ice between the horns, keeping it well front, if possible, the treatment being mainly confined to a course which will keep the excess of blood away from the brain, and drive it into other and less dangerous channels.

It is best to take precautions which will tend to prevent the trouble; previous to calving, place the animal upon short pasture, or keep her in the yard where the amount and character of her food can be regulated; give her little or no grain of any kind, and shorten the allowance of hay; in fact, do anything possible to lessen the flow of blood, so that when it is diverted, there will not be the same amount of danger.

The writer has always found tincture of aconite, in thirty drop doses, valuable as a preventative; it should be given every few hours after calving and for the next two days; it may be given in water, or in a little thin oat meal gruel, by means of a bottle.

"What gives the flavor to butter?"

The first answer to this question would probably be that the flavor of butter is dependent entirely upon the character of the food, and

that its flavor will, more or less, partake of that of the food; and yet your best authorities and most careful experiments clearly show that this opinion must, if adopted at all, be adopted with a considerable degree of allowance.

Prof. Waters, of the Experimental Station, advances the opinion that the flavor is only influenced by the food to a limited extent, but he admits that certain feeds, such as cotton seed meal, gluten meal, rye, over-ripe or musty hay, and even ensilage, if it contains an undue amount of acid, may and do influence the flavor of the butter; but, he concludes that "the conditions surrounding the milk from the time that it is drawn until the butter is worked, exert a much greater influence on the flavor and value of the product than all other factors combined."

Prof. Plumb holds that "food has very little effect on the flavor of butter, except in the case of such foods as onions. I assume that indigestion is quite incidental, for in the so-called fancy herds, where a high class of butter is made, indigestion is more common than elsewhere.

"It has been demonstrated by the work of the Danes, and especially by Dr. Conn, of this country, that the desired aroma or flavor of butter is dependent upon certain cultivation in the cream of certain bacteria."

Dr. Conn himself holds the opinion that the flavor is due to the production, increase and systematic cultivation of certain bacteria, and that the only effect produced by food is in the development of these bacteria, some kinds of food developing them more rapidly than others, and in one of his articles, he makes the following statement: "Some species of bacteria produce very good flavors, some very poor flavors. The butter maker has no way of determining the species of bacteria present, and that will give him the desired flavor. Sometimes he gets the right flavor, and sometimes not. It is nothing but a hap-hazard guess."

Prof. Jordan, of the Maine Station, holds that "it is now thought that the aroma is mainly the product of bacterial action. Undesirable flavors and odors are not infrequently traceable to food eaten. Ill health, particularly derangement of the digestion, may, at times, affect the milk. Certain foods contain oily matters, which in some way not clearly understood, appear to pass into the milk, and are thrown off from the system by this channel. These oils are usually of acrid odor and taste, and taint the milk."

"What is the cause of the present low price of dairy products?"

To answer in a few words, it will perhaps be enough to reply that it is due to over-production and to the grade of the average sample

of butter which reaches the market. The suggested remedy would, then, be to raise the grade of the average sample; but how about the over-production? Is it correct to assume that there is an over-production of first class butter? Is it not the fact that the price for a prime and regular article still keeps up, and that, as in all other professions, there is room in butter production at the top of the ladder?

In answering the question for Wisconsin, Mr. Hoard replies as follows:

"1. The sale of counterfeit butter.

"2. The hard times decreasing consumption very materially. People will not eat so much or as high priced butter when they are out of employment. The farmer and dairyman can see by this how important it is to him that other people prosper.

"3. The changing over of so many cheese factories to creameries, and the making of butter and cheese, both at the same time, in a vast number of other factories, has greatly disturbed the balance between what may be called the milk of cheese making and that of butter making."

As a partial remedy, Mr. Hoard suggests the following:

"1. Organized factory instruction, whereby all factories make as uniform and fine an article of cheese as possible. That fact was seen in the general Canadian exhibit, which averaged together wonderfully in quality.

"2. In her refusal to make a single skim milk, or filled cheese, Canada has the confidence of England, our old customer, because she has played an honest game, and sent out nothing but honest cheese. How many lessons do we need, that cheating the customer is death to the producer?"

Much of the present low price of our average dairy product is no doubt due to the poor quality of the average butter and cheese which we export; this discourages and prevents exportation, and increases the supply put upon the home market, and thus accomplishes its full share in depreciating prices. It may be a fact as stated that but little, if any, filled cheese is made in our State, but what we do make, especially if of low grade, comes into competition with the filled cheese of other states. It is also true that anything which affects the price of cheese will, to a greater or less extent, affect the price of butter in the same direction.

"Can any one so inclined purchase oleomargarine and bring it into the State for his own use?"

Certainly he can. The inter-state commerce law will protect such a purchase until it reaches the one who ordered it, and so long as he

does not offer it for sale in any manner, it is still under the protection of the same law.

The police and other regulations of our State can only affect sales of goods already in the State, but they cannot interfere with the passage of such commodities from dealers or manufacturers outside the State, either to residents of the State or to parties beyond the State. Thus, our cheese law affects all cheese made in the State, but it can have no effect upon New York cheese until it is offered for sale in Pennsylvania; the inter-state commerce act protects the cheese from the borders of our State until it reaches the consignee in this State and protects it there so long as he does not offer it for sale.

Returning to oleomargarine as an illustration, the law recognizes the right of the citizen to use this article, and to purchase it at any point outside the State, or within it either, for his own use; but he cannot use it on a boarding-house or hotel table or at any place at which food in which it is used is furnished or for sale, the courts having decided that if sold with or in articles of food, it constituted a sale interdicted by the laws of the State.

A citizen of our State may purchase the article in our State. The offense against the law is then committed by the seller, and not by the buyer. The latter only comes in contact with the law when he offers it for sale in any manner.

"What is the present status of the oleomargarine question?"

In the eastern portion of the State the prohibitory act is being carried into effect as rigidly as possible but more or less butterine and imitation butter is being sold; in the western part of the State, in a number of cases brought before an alderman in Pittsburgh it was decided that the proviso of section 3 of the pure food law (act of June 26, 1895), authorized the sale of oleomargarine as a "compound" or "mixture." The proviso is as follows: "Provided, That the provisions of this act shall not apply to mixtures or compounds recognized as ordinary articles or ingredients of articles of food, if each and every package sold or offered for sale be distinctly labeled as mixtures or compounds, and are not injurious to health."

The decision of the alderman was that inasmuch as the packages of oleomargarine were marked and labeled so that they were in compliance with the above proviso, and it was claimed that it contained nothing injurious to health its sale in this form was legal and that, at least so far as it conflicted with it, the pure food law repealed the prohibitory oleomargarine act.

This position the Department of Agriculture denied and claimed that oleomargarine is not a recognized article of food in the State, its manufacture and sale having been positively forbidden by the act of 1885.

"Can a private individual or public institute order oleomargarine from a point outside the State for their own use?"

Private individuals may order oleomargarine from a manufacturer or dealer outside the State and, if they do not offer it for sale but use it in their private families, may do so without any violation of the law; a special act (the act of May 23, 1893), forbids the use of oleomargarine or imitation butter under a penalty of a fine not exceeding one thousand dollars or imprisonment not exceeding two years, or either or both, at the discretion of the court.

Section 2 of the act provides that the punishment shall be against "any officer, agent, steward or other officer of any such charitable or penal institution who shall knowingly buy any such substance the manufacture and sale of which is forbidden by section 1 of the act of May 21, 1885," better known as the oleomargarine law.

Another act forbids the use of oleomargarine at any boarding house, hotel or any place at which meals or parts of meals are sold, the theory being that its use at such places is, within the meaning of the law, a sale of the forbidden article.

"What is the best weekly yield of butter upon record?"

If the word "official" is inserted in this question before the word "yield," it will materially affect the answer. Many of the yields placed upon record in the agricultural papers are by no means "official" records, and notwithstanding their large amount, we find that many men who have 14 to 16 pound cows, think that they have about as good ones as any others.

There are numerous tricks about the ordinary record of the papers, even when there is no "padding" of the yield; in some cases we find that the butter fat was obtained by the Babcock test, and then an "estimate" made that 80 per cent. of butter fat will make up the butter; or, that, in other words, one-fourth of the weight of butter fat is added to obtain the weight of the butter. Now it is possible that butter may be "butter" and have but 80 per cent. of fat, but

it is also a fact that some butter has anywhere from 85 to 90 per cent. of fat in it.

"Hoard's Dairyman" for July 15, 1898, gives an account of the test of a Wisconsin cow which gave 33 pounds, 15 ounces of butter in 7 days, and in one day gave 7 pounds and 1 ounce.

The highest yield which we have upon record, and we have lost the data giving names and location, is a yield of 46 pounds, 12½ ounces in seven days; another claims a yield of 1,153 pounds in a year.

At the World's Fair the judges got together 75 cows that were supposed to be hard to beat; it is true that they were under strange surroundings, had come off of a long and tiresome journey, were among strangers, and, in fact, had many items against them; under these surroundings, Brown Bessie made 216 pounds of butter in 90 days, or at the rate of 16.8 pounds per week; her best week showed 19.36 pounds, and her best day 3.48 pounds.

The Ontario (Canada) winter show has adopted the following rules for testing cows:

1. An entrance fee of $2.00 will be charged.
2. The age of the animal will be determined from August 1st.
3. In awarding prizes, the following points will be taken into consideration: 20 points for each pound of fat; 4 points for each pound of solids not fat; 1 point for each ten days in milk after first 30 days limit (limit 30 points).

An affidavit will be required from each exhibitor supporting all points and claims made; another affidavit must show that the animal is the one claimed to be entered, and her registration certificate must be produced.

"In testing a cheese for butter fat, how should the sample be drawn?"

The theory that the proportion of butter fat varies greatly in different portions of an ordinary factory made cheese, does not seem to be supported by facts; in drawing a sample, care should, however, be taken to so obtain it that a fair average of the whole cheese may be obtained; the trier may be thrust in from one side of the cheese towards the centre and then from the opposite side towards the terminus of the first hole, and the two plugs mixed for a sample.

The Department, in order to test the theory of variation, had the following experimental tests made:

A sample plug was taken clear through a large cheese and the rind at both ends excluded, it being admitted that owing to the rubbing in of fats, with pepper and other articles to prevent the entrance of insects, influenced the proportion of fat in the rind; the whole plug

was carefully divided into five portions, but cut at right angles to its length, and these divisions lettered from A to E inclusive. A careful analysis gave the following results in butter fat:

A, ...	35.29 per cent.	D, ...	34.74 per cent.
B, ...	34.16 per cent.	E, ...	35.23 per cent.
C, ...	34.66 per cent.		

The average butter fat in the whole plug was 34.72 per cent.

In another test, made for a similar purpose, eight plugs were taken from as many different parts of a large cheese, with the following results:

A, ...	33.61 per cent.	E, ...	32.75 per cent.
B, ...	32.96 per cent.	F, ...	32.63 per cent.
C, ...	32.65 per cent.	G, ...	32.62 per cent.
D, ...	33.17 per cent.	H, ...	32.62 per cent.

The rind, which in all cases had been discarded, was found to give 40.34 per cent. of butter fat.

In another series of samples the plugs were taken (two in number) from each side of the cheese towards the centre, and each plug was cut into two pieces at right angles to its length; this gave us two plugs from the outer and two from the inner diameter. Samples A and B were those nearest the centre, and C and D furthest from it; the results were as follows:

A, ...	35.53 per cent.	C, ...	34.66 per cent.
B, ...	34.92 per cent.	D, ...	35.51 per cent.

Another and similar test gave the following:

A, ...	32.60 per cent.	C, ...	33.37 per cent.
B, ...	33.75 per cent.	D, ...	32.25 per cent.

"What did Secretary Edge mean by the 'adulteration of butter by the addition of water?

The addition of water and milk to butter is a regular business, and as a natural result, we have both "Process" or "Patent" butter and "Renovated" butter; one made by the addition of materials which coagulate the curd and cause it to mix with the butter, and the whole is colored and sold as butter; by the same or similar patents or processes, water is worked into butter until the chemists of the Department have found, in special cases, as much as forty per cent. water, curd and salt in a sample of butter.

Inasmuch as we have no legal standard for butter, it is difficult to reach such cases through process of law, and it is only by showing the court and jury that average butter does not and should not contain such percentages, and that their presence is a fraud upon the purchaser and consumer, that we can obtain redress against the fraudulent practice.

In the case of Rook vs. McComas, in the Manchester (England) court, Judge Headlam charged the jury as follows:

"It seems to me a question which can only be properly determined by the Legislature after proper inquiry from both sides. The Irish butter trade is a large and important one, especially in this district, and there is some danger, if too high a standard is adopted, that the trade may be driven out of the market; and on the other hand, if the standard is too low, it would produce carelessness and fraud on the part of the manufacturer in leaving water which could have been pressed out. If water is kept in, it seems to me absurd to say that butter is not sold to the prejudice of the purchaser."

Dr. Bell, an eminent English authority, writes: "A greater amount of water than 12 per cent. is unnecessary so far as attaining a good appearance is concerned, and anything over 16 per cent. is injurious to the keeping qualities of the butter."

English custom and court practice seems to have established the following maximum and minimum amounts for butter:

Water,	8 to 14 per cent.
Fat,	80 to 88 per cent.
Curd,	0.5 to 3 per cent.
Salt,	0.5 to 5 per cent.

"What has been the practical results of the use of the scales as a test in the dairy?"

The results will depend very much upon the intelligence and business capacity of the owner and the use which he makes of the information furnished by the test; it of itself will produce no effect, and it is only the application of the knowledge gained which produces the practical results which tell.

If carefully carried out, one of the results of the test will be to show the dairyman that he in reality knew very little of the real qualifications of his cows; those which he had supposed to be the best or among the best may be placed quite low down on the list, and others whose accomplishments were rather sneered at, may be brought forward to advanced positions which will surprise all concerned. The

matter is thus explained by Major H. E. Alvord, of the Dairy Division of the National Department of Agriculture:

"A dairyman of wide reputation, president of a State association for years, concluded to adopt a daily milk record, rather because of those who advocated it than from any conviction of needing it himself. His herd was of his own breeding; he had handled every cow from birth, and he and his sons did the milking. Before beginning the record, he made a note of the joint opinion of himself and sons as to the half dozen best cows in the herd, and an estimate of the season's milk yield. When the year's record was completed, it was found that in order of actual merit, the cows actually stood thus: First, his fifth; second, a cow not on his merit list; third, his fourth; fourth, his first; fifth, his sixth; sixth, like the second, and his second like the third still lower on the list. These were facts verified by subsequent records. Still more remarkable, this experienced owner proved liberally 'by the book' that about one-fourth of his cows were being kept at an actual loss, while others barely paid their way."

Major Alvord further writes:

"Good judges believe that in the entire country one-third of the cows kept for milk do not pay for the cost of keeping, and nearly one-third more fail to yield an annual profit. As a matter of ordinary business prudence and a condition essential to best results, every dairyman should study the individuality of his cows and keep a sufficient record of the quantity and quality of the milk product, to know approximately the cost of production and systematically weed out the herd."

"One of the lecturers yesterday alluded to a certain sample of milk as having 'millions of bacteria in it;' was not this a stretch of language?"

We, of course, cannot write advisedly of the particular sample alluded to, but a statement that a given sample has or may have "millions of bacteria in it," is by no means either a stretch of language or of the imagination.

Last year Dr. McDonnell, acting under instructions from the Department, made a very careful examination into the milk supplies of the leading cities of our State; among the items reported was the number of bacteria per cubic centimeter of each sample; an examination of the tables which accompany his report (See pages 587-597 of annual report of 1897), will show that this number varied from 50,000,000 as a maximum, to 3,500 as a minimum.

In referring to this portion of his report, Mr. McDonnell writes (pages 582-583, annual report of 1897), as follows:

"The Pennsylvania supplies were studied at the hottest season of the year, and the number of organisms found is probably greater than it would be at any other time. The average number found in all of the milk examined, which included all classes of milk, was over 5,500,000 per cubic centimeter. Ten samples contained forty or more millions per cubic centimeter, and ten others contained between twenty and forty millions per cubic centimeter. The large numbers in a few samples make the total average higher than it should be. The worst samples were usually found at restaurants or with small retail dealers, so that such milk reaches fewer persons than that from better supplies. Seventy-seven samples, 28 per cent. of the samples tested, contained less than 100,000 bacteria per cubic centimeter. About 34 per cent. contains less than 50,000 per cubic centimeter, and 124 samples, corresponding to about 45 per cent., contain less than 1,000,000 per cubic centimeter. In Williamsport the weather was very cold and rainy while the inspection was being made, and here the milk from all sources contained an average of 437,000 bacteria to the cubic centimeter, a number one-thirteenth as great as that obtained in all the Pennsylvania supplies."

"Does not the solidity of butter depend somewhat upon the character of the food?"

The character of the feed has much to do not only with the quality of the butter, but also with its solidity; cotton seed meal will harden the butter, while linseed meal has the credit of having the opposite effect, and it is claimed by some dairymen that they can regulate the character of their product by varying the quality of these two kinds of meal.

During a recent visit to the South the writer found a quantity of butter which, even in comparatively warm weather, broke under the knife like hard and thoroughly cooked tallow. An examination showed that it was made almost exclusively from the refuse meal and hulls of cotton seed.

The New Hampshire Experiment Station, after extensive experiments, puts forth a report from which we condense the following summary:

1. That gluten meal tends to produce a much softer quality of butter than corn or cotton seed meal; and, other things being equal, tends to lessen the churnability of butter fat.

2. That with the same cows the hardness of the butter depends much more upon the character of the food than upon the nutritive ration.

3. That ensilage produces a somewhat softer butter than does good hay, but it is also favorable to the flavor and texture of the butter product.

4. That skim milk has a favorable effect upon the churnability and quality of the butter fat, and, in a single trial apparently reversed the general rule that the volatile fatty acids decrease as the period of lactation advances.

5. That cotton seed meal tends to produce an unusually hard quality of butter, and that cotton seed meal and gluten meal might be used together with excellent results.

6. That, contrary to the general belief, the melting point of butter fat is not a good index of the commercial hardness of butter. That while in general soft butter melts at a lower temperature than a hard butter, there is no definite relation between the melting point and actual hardness.

7. That no relation can be traced between food and volatile fatty acids, except in the case of skim milk. That usually hardness and volatile acids vary inversely, hardness generally increasing and volatile acids decreasing, as the period of lactation advances.

CEREALS, ETC.

"What does it cost to produce a bushel of wheat?"

A correct answer to this question is rendered very difficult from the fact that the cost will, in a great measure, depend upon the crop; under similar circumstances, ten bushels per acre will cost about as much per acre as if the crop had been twenty bushels; again, it will of course cost more upon high priced land, as the interest and taxes will necessarily be higher.

A confusing item in estimates of this kind is that of the manure; it is evident that it is not fair to charge the wheat crop with the whole of the manure used, whether it be a commercial fertilizer or yard manure, and different men place a varying estimate as to the proportion which should be charged to the wheat crop. A few years ago, the official correspondents and members of the Board of Agriculture were asked for estimates answering this question; the following is one of the extremely high estimates received and filed:

Size of field, sixteen acres.

160 loads of manure (one-half charged), ...	$160 00
Hauling and spreading manure, sixteen days, ..	40 00
Plowing (first time) ten days, ...	25 00
Harrowing, two days, ...	10 00
Plowing (second time) ten days, ...	25 00
Harrowing, two days, ...	5 00

Drilling, two days,	5 00
Drilling, extra man,	2 00
Seed, twenty-four bushels,	30 00
Reaping, two days,	5 00
Binding, eight days,	12 00
Hauling in, two days,	5 00
Extra men (hauling in),	2 50
Threshing, three days,	7 50
Extra help, three days,	3 00
Cleaning, six days,	6 00
Interest,	96 00
Taxes,	16 00
	$455 00

The crop harvested was twelve and one-half bushels per acre, and hence, adopting our correspondent's train of reasoning, it cost $1.52 per bushel. Had the crop been thirty bushels per acre, the cost would have been but $1.18 per bushel.

This estimate is fairly open to the following criticisms:

1. It is not fair to charge the whole of the plowing, especially that of the second plowing, to the wheat crop, because the ensuing grass crop obtained much more benefit from the extra plowing than did the wheat; in fact, it is an open question whether the wheat was not injured by the second plowing.

2. If one-half of the manure is to be charged to the ensuing crops, it would seem to be but fair to also charge but one-half of the cost of putting it on the field and of spreading it.

3. No credit, whatever, is given for the crop of straw which, to a farmer, and especially to a dairyman, is a very valuable item, and worth all that it would command in the market.

4. No credit is allowed for the ensuing crop of grass, which, without the wheat, would have been a total failure, and which was worth not less than five dollars per acre to the owner of the farm.

Another correspondent gives the following estimate of the cost per acre:

Interest and taxes,	$9 00
Manuring,	4 00
Plowing,	1 50
Harrowing and sowing,	1 50
Seed,	2 50
Harvesting and threshing,	2 50
	$21 00

The actual crop was twenty bushels per acre, thus making the cost $1.05 per bushel.

Estimates were received from official reporters of the Board of Agriculture during the years 1877, 1878, 1879 and 1880, and the average estimate of the cost of a bushel of wheat was 89 cents.

"What causes the process known as 'tillering' in wheat and rye?"

The process known as "tillering," may properly be said to be the result of education or breeding, and it has been clearly shown by Sir Frederick Hallet and others, that it may be increased almost indefinitely by careful cultivation and selection of seed. The extent to which Hallet carried his experiments was somewhat extraordinary, and at the time aroused the attention of the scientific world.

Carefully planting one grain in a place, he gave the resulting stalk a fair chance to obtain light and heat, and thus he encouraged and increased the habit until he could obtain from one grain in a place, and ten inches square, as good, and in fact, better stand of wheat as was obtained with one-and one-half or two bushels of seed per acre. He also found that tillered grain was able to maintain itself erect against storms and heavy manuring.

Along with this breeding of the tillering habit, and side by side with it, Hallet carried the other habit of increasing the number of grains in each chest upon each side of the head; this habit he also found could be bred in or out with as much regularity and certainty as changes could be made in the formation of animals, and he also carried it to an extent which was a surprise to the farmers of England, at the time the experiments were published.

We may, then, answer that "tillering" is a habit which can be bred into or out of the grain at the will of the cultivator, and that the greatest incentive to its increase is to give each part ample room for its full development, and then selecting the grain from the stalk or stool which gave the best results. Hallet claimed that in each stool there was always one best head, and that in this head there were two best grains, and that these grains were always to be found in the middle of opposite chests, at or near the middle of the head. These were the grains which he selected for seed in his experimental plots, and his success was due to their use.

It has also been proven by careful experiments that this habit may be increased by gradually decreasing the amount of seeding, and affording to each grain a fair chance for the development of its growth and tillering power. It has also been distinctly proven that

the stronger the soil, the greater the tillering power of the seed, and that seeding may be much lighter upon strong wheat soils than upon those which are not well adapted to the growth of the crop.

"Does it pay the farmer to store his grain for higher prices?"

Holding grain for higher prices partakes more or less of the nature of speculation, which is not intimately connected with farming, and we think it will be found that if the average of fifteen or twenty years is taken, that holding grain for higher prices does not produce sufficient profit to make it pay.

Secretary Bonham, of the Ohio Board of Agriculture, when asked "What is the gain in selling new wheat from the thresher at 75 cents over keeping it four months and selling it for 80 cents?" he replied as follows:

"When the granary is so tight as to protect against loss by vermin or thieves, it is safe to count on taking out as many pounds in February or March as was put in in August or September. The factor, however, that has concerned me more, is the labor. I have sold from the thresher, hauling direct to the elevator, and have stored it in the granary and for a short time on the barn floor, when I could not get teams enough to haul to the elevator as fast as it was threshed. Keeping an accurate account of the cost of the two methods, I have concluded that there is a saving in labor of five cents per bushel by hauling at once to the elevator. Unless one is sure of more than five cents advance, it is better to haul grain to market as it comes from the thresher, when we thresh from the shock or stack."

"What is the Lois-Weedon system of wheat culture, alluded to in a recent article in the 'Country Gentleman?'"

The Lois-Weedon system of culture is practically a revival of the theory of Jethro Tull, that tillage was a substitute for manure, and that if the soil was properly stirred by plowing and harrowing, and allowed to remain without the exhaustion following the removal of a crop, it would recover its lost fertility, and that by this means, without the use of any manure or fertilizer, the amount of the crop would be increased year by year.

Rev. Mr. Smith, of Lois-Weedon, Northamptonshire, England, acting upon this theory, laid out his field in narrow strips, each alternate one of which was carefully planted with wheat, and the vacant

strip thoroughly plowed and cultivated, while the adjacent crop was growing. As a result of this experiment, he was, without the use of manure of any kind, able to increase the crop of wheat from sixteen to thirty-four bushels per acre.

While the grain was growing, the vacant strips were, by absorption from the atmosphere and by the disintegration of the soil, accumulating the fertility for the next crop.

As a scientific experiment, the attempt was a success, but as a profitable result, it was a failure. The fertility obtained in this manner cost too much and rendered the crop too expensive.

The result of the experiment, so far as it goes, shows the value of frequent and complete cultivation; it is valuable, because it shows that, by processes of nature, it is possible to add fertility to soils without fertilizers, but its benefits go no further.

"How deep should ground be plowed for corn?"

The terms "deep" and "shallow," as applied to plowing, are merely comparative; three inches deep in three inch soil is practically as deep as five inches in a soil five inches deep. No one can lay down any rule, as circumstances and surroundings must in all cases govern.

Inasmuch as the decomposition of the sod is retarded by being turned under deep, it may be inferred that the corn crop will get the most benefit if the sod is turned over just deep enough to get a good and firm furrow. If the sod is clover instead of natural grass, the rule must be changed and, inasmuch as the furrow is seldom if ever turned over flat, the plowing may be to the full depth of the surface soil; in no case is it profitable or advisable to bring up much of the stiff and solid sub-soil.

"When is the proper time to sow clover seed to obtain the best results?"

It is impossible to fix a date, as the time will vary from year to year. In these days of broadcast seeders, it is best to sow at several times; by the use of a good seeder it requires but a few hours to go over a ten acre field, and they can be adjusted to sow any required amount of seed. It involves but little additional cost to sow the seed at three applications, and if one fails, the other two may be better in their results.

In many portions of our State the main difficulty is not so much

to get the crop started, as it is to get it through the dry weather which often comes on after the wheat has been harvested when the young clover is exposed to the dry weather and hot sun.

"Are corn harvesters profitable for use in a ten acre field?"

The only unsolved question in the use of corn planters is their ability to stand the wear and tear of the work; in many of them the working parts are quite light and they have not yet been tested long enough to know whether they will wear well; the item of repairing and replacing farm machinery is an important one, and one that is too often lost sight of in comparing the cost of harvesting by hand and by horse power; in too many cases we forget that the whole machine must be replaced, even with good care, at the end of ten years, and that the annual repairs will probably cost about ten per cent. more, thus making the actual cost of the machine not far from twenty per cent. of its original cost.

Suppose that this original cost has been one hundred dollars; it follows that it costs about twenty dollars per year to use the machine, not counting the horses and man; if, with this outlay the work is more cheaply performed than by hand labor, then the machine is the most economical.

It is sometimes the case that hand labor cannot be obtained when wanted and in that case the item must be counted on the machine side of the account.

After a few years more of practical tests we will know better as to the profit of the corn harvester, but the fact remains that they perform their work well and save a great amount of time, especially in harvesting ensilage.

"How should seed corn be selected, and how planted?"

There can be no room to doubt the great loss which annually takes place from poor seeds, especially in localities in which early planting is practiced; it has been estimated that, taking one year with another, fully ten per cent. of the crop is lost by the use of poor seed. During years in which hard, freezing weather sets in before the corn in the crib has thoroughly dried, the loss from bad seed is very great, and often amounts to much more than the above estimate. The germ is injured by cold before it has become sufficiently dry, and a failure to grow results.

In the annual report of the Board for 1883 (page 307), the following in relation to the care of seed corn and of planting, is found:

1. That the proper care of the seed, from husking time until planting time in the next year, is one of the very important considerations. That by far the safest and surest plan is to select the seed when husking or hauling in, and at once place it in a dry place, where it will not freeze, at least until it is thoroughly dry.

2. That the position of the grain in the ear has very little influence upon the product; but for convenience and certainty in drilling, the smaller and imperfect kernels at both ends of the ear should be discarded.

3. That the annual and careful selection of good, perfect ears, with small cobs in proportion to the grain, will pay, and that in this way the yield per acre may be increased.

4. That the depth of planting should not exceed three inches, and that during a cool season, the greater depth is preferable.

5. That soaking the seed is of no practical benefit, unless it be to prevent the ravages of birds, and that all the advertised nostrums are, so far as the actual increase of the crop is concerned, valueless.

6. That planting in drills will not increase the crop sufficiently to pay for the increased cost of cultivating and harvesting the crop, and that any gain in this line must result from the amount of time saved in getting the crop into the ground.

7. That manuring in the hill (close to the seed) will not pay, and that the benefit is mainly in the appearance of the crop, and not in the field.

8. That in dry seasons the use of fertilizers will not pay so well, probably because they cannot become available during the short season of growth, and that barn-yard manure is not exempt from this deduction.

9. That the average corn crop costs the producer (all items counted), not far from forty-four cents per bushel.

During the same year one of our correspondents gave the following items in the cost of his corn crop:

Size of field, 16 acres:

One hundred and sixty loads of manure (one-half charged),	$160 00
Twelve days' plowing,	30 00
Four days' harrowing,	10 00
One day marking out,	2 50
Three days' planting,	7 50
Three days' harrowing,	7 50
Three days' replanting, etc.,	3 00
Seed corn,	1 20

Cultivating and hoeing, ...	16 50
Twelve days' cutting, ...	12 00
Husking 1,040 shocks, at three cents, ...	31 20
Hauling, etc., ...	20 00
Interest and taxes, ...	112 00
Total cost of corn on sixteen acres, ...	$413 40

"What is the most economical manner of raising broom corn, and is it a profitable crop?"

The following practical directions from a Kansas grower of this crop, gives a fair insight into the manner of cutting and curing the crop:

"Breaking and cutting broom corn are both done by hand. When breaking it down, the men walk forward. Each man takes two rows. He bends the stalks about two feet above the ground, and lays the stalks down cross-ways behind him at such an angle as will put all the tops or brush hanging outside each row, where they will be handy to reach when he walks back to cut them. Two rows, thus broken down, are called a table. When the men have broken clear through the field, each one steps between two tables, one of which broken by himself and one by the workman nearest to him. They then commence cutting, which is done with an ordinary shoe knife, with a very thin blade from six to eight inches long. In ordinary thick broom corn, that stands up well and is not tangled by storms, a man is expected to break and cut a table one mile long in a day, in order to be entitled to full pay. From six to eight inches of the stalks are cut off with the brush for handles. The brush is piled in small bunches, something like an unbound wheat sheaf, on every alternate table. After the cutters have gone once through the field, the hanlers can commence to haul it to the sheds. The team and wagon are driven straddling the table that has no piles of brush, and on each side of the wagon one man walks to load the brush.

"The brush should be hauled to the shade immediately after being cut, and the seed stripped or scraped off. This is done by machines made for that purpose, called scrapers. The brush is fed into a two cylinder chain scraper held by the chain, and then dropped out at the opposite end. This machine is both the fastest and easiest operated. Six tons per day can be scraped on one of these horse-power scrapers. Another kind called hand scrapers is used by smaller growers, though it is a horse-power machine. In these the operator has to hold the brush by hand while the seed is scraped off. This

is hard work and quite dangerous, and brush cannot be scraped more than half as fast. As soon as the brush is scraped, it is carried into the shade and laid on poles, or slats, to dry.

"The brush must lie on the poles until it is dry enough not to heat after it is bulked down or is baled. The time required for this varies according to the dry condition of the weather. It is considered perfectly safe to bulk down broom corn when no sap can be twisted out of the handles close to the fibers. It will keep fully as well and as long in bulk as in bales."

The same authority gives the following items of the cost per acre in Kansas:

"Rent of land, two dollars; clearing off corn stalks or weeds, twenty-five cents; plowing, one dollar and twenty-five cents; harrowing twice, twenty-five cents; planting, twenty cents; cultivating twice, seventy-five cents; cutting, five dollars; hauling and scraping, five dollars; bulking down, forty cents; baling, sixty cents; use of machinery, fifty cents; wire, fifteen cents; hauling to market, fifty cents; total cost, seventeen dollars."

The yield of the crop is estimated at from 700 to 850 pounds per acre, and the price is given as four cents per pound; with the former yield, the value of the crop, not allowing for the seed, is twenty-eight dollars, and the profit seventeen dollars per acre; with a crop of 850 pounds per acre, the value of the crop is eighteen dollars per acre.

"What is the least amount of wheat which can profitably be drilled per acre?"

It is well known that different kinds of wheat vary very much in their power to "tiller" or spread from the original root; it is also well known that much less of some kinds may be used than of others, and at the same time secure quite as thick and good a stand. Much also depends upon the size of the grain, and those who have never given the matter attention, will be surprised to discover that allowing one plant for each grain, some kinds of wheat have one-third more grains to the bushel. Thus, for instance, the Bowden white wheat was not only quite small in the grain, but it also possessed the "tillering" power to an unusual degree.

It has also been clearly demontrated by the experiments of Sir Frederick Hallet, of England, that this power of tillering may be cultivated and greatly increased by careful selection, and, as he termed it, breeding. By carefully giving each grain all possible opportunity to tiller, and then selecting the best grains from such

stalks as tillered most, he obtained a species of wheat known by his name, which could be planted a grain in a place of six inches square, and secure a heavy stand of grain that never went down under liberal manuring.

In his seed fields his rule was to plant a single grain, by hand, in squares of ten inches each, and the crop invariably covered the ground, and gave yields that surprised those who had never given the matter much attention. He obtained his results by the careful selection of the best grains from the best stock from the stool which tillered most, and thus all credit was due to what he styled careful "breeding," which, in turn, was the result of selection.

"Will not the general introduction of machinery for cutting, planting, digging and sorting potatoes have the effect of increasing the average crop, and decreasing the price?"

This is the natural result of the introduction of labor-saving machinery by which one man is enabled to perform the work of a number. This was the natural result of the introduction of reapers and binders upon the price of wheat; the acreage and yield of the crop was, by the use of improved machinery of all kinds, greatly increased, and the amount produced being beyond the demands of consumption, the price fell proportionately.

Had gang plows, drills, reapers, binders and steam threshers never been invented or used, the acreage of wheat would not have increased so rapidly, and the price would probably have advanced with the increased cost of manual labor. By the use of improved machinery, one man could accomplish the work of six or seven, and one-half the number of men could readily double the acreage devoted to the crop. This, coupled with the cheap land of the west, have all had the same tendency; that of increasing the acreage and yield, and decreasing the cost of the crop; either of these forces would naturally decrease the price of the crop, but both working together, have undoubtedly been the prime factors in the present depression of the agricultural interests.

Machinery for cutting, planting, digging and sorting potatoes will decrease the cost of the crop, and will enable one man to perform the work of ten; this will cause an increase in acreage until the supply exceeds the demand, when the price must necessarily fall until it reaches a non-paying point, when it will turn in the other direction.

"Is potato rot produced by planting diseased seeds, or is it due to atmospheric causes?"

This disease is due to a minute vegetable growth which in turn is propagated or increased very rapidly under certain atmospheric conditions. If after the crop has attained a certain stage in its growth, we should have warm rains followed by hot weather, the minute growth which causes the trouble will increase with such rapidity that the crop is destroyed. Under other conditions but little harm is done, and but few, if any, rotted tubers are found. If the germs which produce the disease are in the air or ground it is very difficult to prevent injury, but there are numerous well authenticated experiments in which spraying has produced excellent results and saved the crop.

"What is the legal weight of a bushel of potatoes?"

The act of June 1, 1891, says: "That from and after the passage of this act, the weight of a bushel of potatoes shall be fifty-six pounds."

The main argument used for the passage of the act and for a reduction from the former standard of sixty pounds, was that in the neighboring state of Maryland, the legal standard was fifty-six pounds, and that more or less fraud was practiced by dealers taking advantage of the difference in the standards.

The establishment of standards is of doubtful utility, as it would make much less confusion to adopt the California plan and sell by weight, the quotations being in one hundred pounds or centals and their fractional parts. After a little practice it requires no more time to weigh a half peck of potatoes than to measure them, and many disputes as to the mode of measurements would be avoided.

"Is the character of the potato affected by the character of the soil upon which it grows?"

There are few crops which are more readily affected by soil, season and fertilizers than the potato, and it is evident that in many cases, in our attempt to grow large crops we succeed at the expense of quality. Potatoes raised upon a moderately loose or micacious soil are of the best quality while those raised upon new soil full of decaying vegetable matter, while exceeding in yield, are deficient in quality and flavor.

Potatoes raised with green barnyard manure are injured and this

fertilizer should be used the preceding year to some crop like corn which will prepare the soil for the following potato crop. Fertilizers rich in nitrogen increase the yield but injure the flavor almost in exact proportion to the percentage of nitrogen in the fertilizer.

"Have potato growers gained anything by the decrease of the legal weight of a bushel of potatoes from sixty to fifty-six pounds?"

Practically, nothing at all; any purchaser, knowing that he is to get fifty-six pounds fixes the price accordingly; any other course is not reasonable or business like. The fact is that it is time that our farmers should realize that State standards are only of use in settling disputes between seller and buyer, in the case of sales in which nothing definite has been fixed. If I purchase potatoes of my neighbor and fix no standard in the bargain, I, of course, cannot compel him to give me more than fifty-six pounds to each bushel, but I might, without any violation of law, have fixed the standard in the bargain at one hundred pounds; the only difference would have been that I would have been compelled to pay proportionately a higher price per bushel.

In California there are practically no standards and farm commodities are quoted by the cental or the one hundred pounds, and purchasers buy fractions of cental by weight. This plan avoids all disputes as to measures, and would take away from the sweet potato vendor the value of fixing the potatoes in the half or quarter of a peck. If he sells by weight, he has no interest or gain in placing them in the measure and his occupation, at least in this respect, would be gone.

It is stated that after dealers get used to it, weighing involves no more trouble than measuring, and is much more satisfactory to both parties interested, and it certainly does away with all bickerings as to State and other standards of weight.

"Are potato planters a success?"

In most cases the planter will miss a few hills in each row, but when the cheapness with which the crop is planted is taken into consideration and the opposite side of the account charged with the extra cost involved by hand planting, the use of the horse power planter is profitable.

The main objection urged against them by practical growers is that the shoe or plow which makes the furrow for the cuttings compacts the soil, and is apt to leave a permanent furrow; this, we think, is

usually the case in heavy soils worked when too moist and that the objection is removed when the proper soil for potatoes is secured and when this is worked when in the proper condition; the time required for planting by horse power is so short that any one can afford to wait until the soil is in just the proper condition.

If the defect claimed exists, manufacturers will soon find a way to remedy it and they are not slow to reconstruct their machines so as to meet defects and suit the wants of those who buy and use them.

If I was planting potatoes upon a large scale, I would certainly use both the planter and the digger, expecting that any loss which might arise from missing hills would be more than made up by the economy and saving in the expenses of planting as compared with hand labor.

"In an address Prof. Heiges alluded to the formation of new varieties of potatoes by the use of the male flower of one kind, and the female flower of another kind. What is the meaning of this?"

All plants have two sets of reproductive organs, one of which has been styled the male, and the other the female. Our common corn plainly represents this, the tassel being the male organ and the silk the female. The grain, in this case, can only be produced by a deposit of pollen from the tassel upon the silk; this pollen may come from another plant, and hence, the fact that different varieties will mix. In some cases, the pollen is carried from plant to plant by the wind, and in others it is carried by bees.

Some strawberries have both sets of flowers upon the same plant, and others produce but one set of flowers, and can only be fertilized and bear fruit through the agency of pollen from another variety Trees produce but one variety of flowers upon the same tree, and hence, only produce fruit or seeds when planted in considerable numbers; of this class, the common osage orange may be taken as an example.

The plan proposed by Prof. Heiges, was to fertilize the female flower of one variety of potato by the pollen from the male flower of another variety. If varieties are planted sufficiently near together, nature will accomplish this without aid, but it is, of course, accomplished in a hap-hazard way, and there is no certainty in the production from the seed thus obtained. But, by carefully selecting female flowers from a valuable variety, and crossing them by pollen from the male flowers of an equally valuable variety, but having other valuable traits, it is claimed that we can control the character of the potatoes produced from the seed, and that we may combine the good qualities of both parents. Thus, Prof. Heiges

stated, that he had produced a new and valuable variety by crossing the Mammoth Pearl and the Snowflake; he claimed that the Mammoth Pearl was noted as a producer of a large crop of large tubers, while the Snowflake, of much better quality, produced too many small and medium sized tubers; his object was to combine the large size and producing qualities of the Mammoth Pearl with the good table qualities of the Snowflake, and he stated that for this purpose he used the female flower of the Snowflake, fertilized with pollen from the Mammoth Pearl.

"Will the use of small potatoes for planting cause a deterioration of the crop?"

Probably, "yes;" but not necessarily, because they are small. In discussing this question, we generally lose sight of the fact that the potato is not a root; it is simply an underground stem, and not a root in the same sense as is the parsnip or beet. Being an underground stem, it is subject to the same laws and rules as is the stem above ground; the operation of planting the potato is simply that of budding simplified; we insert the cutting, the cut potato into the scion, the soil, and the connection is completed.

If a small stem will deteriorate the tree which it produces, then a small potato will necessarily deteriorate the tree produced from it, and so will the small and immature potato deteriorate the crop produced from it, not because it is small, but because it is immature and not properly ripened.

If, from peculiarities of season or location, the potatoes are small but thoroughly ripened, we need have no fears in using them for seed, but if through other causes they have not fully ripened, their use is dangerous. The small potatoes are, usually, those last set on the stem, and are small because the close of the growing season or the ripening of the vine found them not fully matured. If they had received a fair chance, their size would not have interfered with their ripening properly, and no injury would have ensued from their use for planting.

"Does pasturing injure clover for cutting for hay?"

The question of injury will greatly depend upon the condition of the clover when pastured; if it is too close to harvest or after the clover has been cut short, it will certainly injure it seriously, and many fields are thus permanently injured. But if on the other hand,

it is pastured after it has made considerable growth, the operation is an advantage in preventing too luxurious growth which may fall down during the winter, and by harboring mice and excluding air, may injure the crop greatly. After the crop has made a moderate growth, pasture, but not so much as to deprive the roots of their necessary protection and covering from the dry weather and hot sun of autumn or the cold of winter.

"Is it probable that the present low prices of farm stock will continue?"

The indications now are that we have about reached the lowest prices for horses, but, owing to an actual scarcity, it is quite probable that the prices of feeding cattle will advance for a few years yet; our Western farmers have run to 'corn" largely, and have, in very many cases, sold off their breeding stock. It requires some time to get up a stock of horses and cattle, but sheep and hogs can be increased in a short time.

One of our Western breeders and cattle feeders writes as follows in relation to the future of horses and cattle:

"I see nothing in the near future to justify the extravagant prices now being paid for feeding cattle. That we are short on cattle there can be no question, and we will not be otherwise very soon, but there is no more reason or sense in us riding over one another and paying extravagant prices to get these cattle than there was only a few years ago when we were doing the same thing to get rid of them. How inclined we are as a people to quit a thing when it costs us the most to quit, and go at something else when we must pay high for the privilege of doing so? The past few years it has been corn, corn, corn; now we want more hay, pasture and cattle. Cattle are all right and will be for some time, but I think the farmer who now begins the breeding of good horses will have as profitable an investment as the farmer who now begins again breeding cattle, and as the cattle and horse breeding business is again revived, the farmer who raises the corn will also do a profitable business. I like horses only for their valued service, but I firmly believe that good two-year old colts at the price they can now be bought for, will be a more profitable investment than will be the good two-year old steers at what they are now selling for."

"Is there any profit in the production of poultry?"

This question may be answered either in the negative or affirmative, and both answers be correct; all depends upon the standpoint

from which the occupation is viewed; to those who make it a study, and follow it intelligently, it is, and always will be, profitable; to those who follow it in a careless, hap-hazard sort of way, it is not profitable, and never will be. It is like all other branches of farming; there are those who make a good profit out of the ordinary crops, and there are those who figure up a loss upon the best.

Probably one of the most careful and complete experiments in the production of poultry for meats, is that of the New York Station, (report of 1893, pp. 214-219), and the best condensation that we have yet found from it, is the following from the Experiment Station Record (Vol. IV, No. 2, p. 1022):

"About 130 Cochin and Leghorn chickens were hatched by the natural method, for the special purpose of obtaining pullets for use in a feeding experiment. Of the Cochin eggs set, 46.1 per cent. produced healthy chickens, and of the Leghorn eggs, 75.2 per cent. Counting the eggs at 24 cents per dozen, and the food eaten by the sitting hens at local prices, the cost of each chick when hatched was 4.65 cents for the Cochins, and 2.82 cents for the Leghorns. The hens were kept with the chickens from five to six weeks. The food of the growing chickens was cracked wheat, skim milk, dessicated beef, finely cut fresh bone and mixed grain, which was varied from time to time. The chickens remained healthy, and only a few were lost from accidents. The sexes were separated, when the Cochins averaged 109 days old, and the Leghorns 84 days old. At the time the Cochins averaged 4.05 pounds, and the Leghorns 1.83 pounds. The average cost per chick (including hatching), amounted to 24.36 cents, or 6.01 per pound for the Cochins, and 12.59 cents. or 6.88 cents per pound for the Leghorns.

"The pullets of both breeds were fed 11 weeks longer, at an average cost per fowl of 20.07 cents for the Cochins, and 13.19 cents for the Leghorns, at which time the Cochin pullets averaged 5.53 pounds, and the Leghorns 2.81 pounds. Deducting from the total cost to date, the local market value of the cockerels at the time the chickens were separated, gives the net cost of the Cochins at 13.24 cents each, and of the Leghorns 16.78 cents."

In commenting upon this experiment, Prof. Wheeler makes the following statement:

"The sexes were about equal with the Cochins, but there was an unusual excess in the number of pullets among the Leghorns hatched (37 per cent. more pullets than cockerels), so that the poultry value of the cockerels represented a lesser proportion of the value of the food consumed. Had the sexes been equal, at the same proportionate cost for growing, and considering the poultry value of the cockerels, the net cost of the Leghorn pullets would have been 13.35 cents each, nearly the same as that of the Cochins."

"Is crimson clover a valuable crop, and what position does it occupy in the regular farm rotation of crops?"

Crimson clover is a valuable crop, but it can hardly be said to occupy a place in the usual farm crop rotation of corn, oats, wheat and grass. It is not a substitute for the common red clover, and cannot take its place in the rotation. It is not a biennial, like the red clover, and survives but one year; for once heading out and going to seed, it cannot be depended upon as a continued hay producer.

It is possible, however, to bring it into a farm rotation of crops by sowing it at the last working of the corn, and covering it with the harrows; the ensuing spring it will make a vigorous growth, and in this locality will be ready either to cut for hay, or turn under as green manure, by the 20th of May. The main difficulty in giving it this place in the rotation is that corn stubble is usually too rough for mowing, but as a green crop to turn under, it has scarcely an equal, when the short time which it occupies the ground is taken into consideration.

Robert M. Simmers, a Chester county market gardener, finds it of great value in his rotation, and uses it either as a green manure or for hay, as the necessities of the case may warrant.

At the last working of corn for boiling ears, he sows the crimson clover at the rate of from ten to twelve pounds of seed per acre; by the middle to the 20th of the succeeding May, it is in head and may either be turned under for manure, or cut for hay. In either case, he at once plows the ground and plants late corn or cabbage, and when these crops are off, again seeds down with the crimson clover, and follows up the same rotation with the same or other market garden crops. He states that no matter whether the clover is turned under as a green crop, or cut for hay and the sod turned under, he can see to the furrow where the clover grew, and he is perfectly satisfied with the results. One benefit claimed by him is that it practically renders him independent of his fields for hay, for if the season has been unfavorable for hay in the main fields, he can cut his crimson clover for hay.

Calvin Cooper, a member of the State Board of Agriculture from Lancaster county, makes use of crimson clover as a "catch crop" after potatoes, corn for ensilage or fodder, and, in fact, after any moderately early crop. If hay is scarce, he cuts it for hay, and has had from one and one-half to two and one-half tons of hay per acre. He states that the most critical time with his crop is just after it has fairly sprouted, and before the roots have fairly established themselves; a drought at this time is very injurious to the crop, and is a cause of failure in many cases.

Some of our correspondents state that they have had good results

from harrowing vacant spots in mowed fields, soon after harvest, and seeding with this crop; but the great difficulty of this plan is to be found in the fact that the crimson clover is ready to cut before the common red clover, and that, consequently, is left until the surrounding grass is ready, and it gets too ripe for first class hay.

Those who are used to the common red clover usually make a miss with the crimson variety, by too thin seeding; the seed is, if well developed, quite large, and does not stool out any; from ten to fifteen pounds per acre is the best amount; the larger amount being best, if the soil has not been well prepared. Thinner seeding will not produce a sufficient stand to keep down weeds, and the result is usually second class hay.

It is important that the seed should be of the previous year's growth, for old seed seldom germinates properly, and its use, even at half price, is not to be recommended. The fact that it is a wonderful seed producer, will, when the market once gets fully supplied, keep the price down.

"Are the results of experiments which depend upon crops produced upon fractions of an acre to be relied upon?"

The value of such results will, in great measure, depend upon the number of the experiments and the thoroughness with which the results are obtained. A half acre may be divided into eighths, and seven kinds of fertilizers be applied to seven of the plots and nothing to the other, and the results of the single experiment would be utterly valueless, because if nothing at all had been applied to any of the plots, the variation would probably have been quite as great. It is impossible to select an acre which can be divided into eighths, each of which shall yield, even approximately, the same results.

A single experiment by one farmer with any given fertilizers, and for but one year, proves nothing at all. Such an experiment, by the same farmer, and for a number of years, gives us the results of that fertilizer upon this land, but the results may not be applicable to an adjoining field or farm.

The experiments reported by our Experiment Stations are valuable, because they give us, not the result of a single experiment, but the results of a long series of experiments, all pointing in a certain direction.

Nothing is gained from the report of a single experiment with John Jones' Excelsior phosphate, nor is anything of practical value gained by a series of experiments on the same soil or farm with this fertilizer. But our Experiment Stations, by their reports, show us

the results of applications of nitrogen, phosphoric acid or potash, or their combinations, on the soil and upon certain crops, and from these results we may obtain general deductions of great benefit to all.

"Will alfalfa do well in Pennsylvania?"

The average experiment with alfalfa in this State has not been a success, and I do not know of any plots which can be made to cut a really good swath or to yield one-fourth as much as common clover would have done with the same care and manure and under the same circumstances. The indications are that the continued thawing and freezing of our spring and fall is fatal to it, probably breaking off its top roots and thus killing it.

In some portions of California, where it can be irrigated during the dry season and where the changes of temperature are not great, as much as nine tons per year of comparatively good but coarse hay may be cut from it per acre, but it is in no case as good for feed as hay, it being more like pea vines, and often, especially if thin on the ground, too woody for the best of hay.

It has been stated by some that if it can only be well started it will do well, but if it cannot be started this argument is of little avail. Better stick to the common red clover in our variable climate and especially upon stiff soils.

"Has the value of ensilage for fattening steers ever been tested, and if so, with what effect?"

One of the main claims of our ensilage farmers is that it enables them to obtain more feed from a given amount of corn and at a less cost than by the old fashioned way of cutting and husking; if this claim holds good, and the indications are that it will, then it follows that there is as much advantage in feeding ensilage to fattening cattle as to milk cows.

Several years ago the Masaschusetts Agricultural Experiment Station made use of ensilage in feeding a lot of cattle, and from the results of this experiment and the report of the Station, we give the following:

1. Corn ensilage when fed with wheat bran and gluten meal, or with wheat bran and old process linseed meal, has produced in our case, without exception, the highest gain in live weight as compared with other fodder rations used in the experiment.

2. The increase in live weight per day when feeding the ensilage fodder ration to one year old steers has in one instance exceeded

three pounds, while in the case of two year old steers, it has averaged more than four pounds per day.

3. The cost of the feed (corn ensilage), consumed per day has been from 12.82 cents to 14.72 cents in the case of one year old steers, and from 16.67 cents to 19.33 cents in the case of two year old steers.

4. The net cost of the feed consumed per day has been from 4.81 to 5.25 cents in the case of one year old steers, and from 6.65 to 7.44 cents in the case of the two year old steers.

5. The daily increase in live weight of the one year old steers during both periods of feeding the ensilage fodder ration, averages 2.9 pounds. The original market cost of this diet averages per day 13.29 cents; hence, the original cost of feed consumed per pound of live weight gained amounts to 4.8 cents, while the net cost of the food consumed per pound of live weight gained amounts to 1.82 cents.

6. The daily increase in live weight of the two year old steers during both periods of feeding ensilage fodder averages 3.45 pounds. The original market cost of this daily diet averages for both periods per day 18 cents; hence the original market cost of the feed consumed for every pound of live weight produced amounts to 5.22 cents, while the net cost of the feed consumed per pound of live weight gained was 2.08 cents.

7. The difference in financial results presented above, and of the subsequent financial summaries of the entire feeding experiment, is due to the less profitable daily fodder ration used during the experiment in connection with the ensilage fodder ration.

"What is the Soy Bean, and how is it cultivated?"

The Soy Bean was originally a native of China and Japan, where it was cultivated as a green manure, and, to a limited extent, for human food; it has been experimented with in Europe and this country during the past fifteen or twenty years with varied success. The National Department of Agriculture reports that "The Soy Bean requires about the same class of soils as Indian corn, and will grow about as far north as that crop can be depended upon. The best results with it have been obtained in that region between the thirty-seventh and forty-fifth parallels east of the Rocky mountains. The regions best adapted to it, is the 'corn belt,' a circumstance which argues well for its future use and value in conjunction with corn for fattening animals."

The seed should not be planted until the ground has become well warmed, and of the many varieties it is always best to make use of the earlier kinds; it may be sown broadcast or in drills at the rate of

from two or three pecks per acre; the burden of results is in favor of the heavier sowing, as the crop is somewhat apt to grow too coarse and woody for good fodder. It may be cut for hay in about the same condition as common clover, and if left to become too ripe, loses much of its value for hay.

It has been tested for ensilage with good results, but can hardly be considered as a successful competitor with corn for this purpose; in fact, its greatest value seems to be obtained where it does not come fairly in competition with corn.

The yields of seed (beans) varies with the character of the soil, the rapidity of growth, the amount of weeds and other causes, but may be placed at any point from 15 to 100 bushels per acre, the latter being only the result of the best cultivation upon soils well suited to its growth; its yield may, however, be placed at about that of corn under the same conditions.

FRUIT, FRUIT TREES, ETC.

"How deep should apple trees be set?"

In no case deeper than they grew in the nursery, and this can always be ascertained by the surface marks on the young trees; it is an error to dig deep holes, and after filling them partially up with rich soil, to set the tree at a greater depth than it has heretofore grown; such a plan may, for a short time, ensure a vigorous growth, but when the young roots grow out beyond the soil which has been filled, and reach the hard sub-soil, their growth will be checked, and the young tree will, so far as growth is concerned, remain stationary, and may, during this period of checked growth, become a prey to some of its many enemies.

One of our veteran fruit growers, when asked how large the holes for fruit trees should be dug, replied, "as large as the orchard," that is, the whole soil of the orchard should be well prepared, pulverized, and put into good order before planting, and then the size of the holes need not be more than is sufficient to place the roots in their proper position for natural growth.

A very common error in orchard planting, is due to the desire of the grower to obtain large trees as early as possible, and consequently, he does not set them back sufficiently before they are planted; it must be remembered that the roots have been vigorously shortened, and that the tops should be decreased in about the same proportion, in order to keep up the proper balance between supply and exhaustion.

In answer to a question relating to the planting and treatment of

an orchard, George O. DeGraw gave the following advice at one of our Susquehanna county farmers' institutes:

"When setting the tree, use the rich surface soil, and it cannot fail to make a good start. When young trees are taken from the nursery the roots are very much shortened, so in transplanting, the tops should be cut back in proportion. The apple tree will bear severe pruning. I have, in my experience, found it an excellent plan in starting young trees, to cut the top back to two or three buds on each branch, allowing these to grow until they get a good start, and then prune those that need it. In this way a person with good judgment will form a fine, uniform tree the first season. Some branches will be inclined to reach out too far at the expense of others. This is easily remedied by pinching them off when they have reached their proper length. This will cause side shoots to start, and form a bushy head; it will also throw some of the sap into the weaker branches.

"The ground in a young orchard should be kept cultivated with some hoed crop, using plenty of manure spread broadcast, and worked into the soil, so that the crop taken off, which will pay for the labor of cultivating, will not impoverish the soil. By constantly stirring the soil, the plant food is set loose, and the roots can more readily take it up, and the tree will make a more thrifty growth."

"Are there not more rapid means for making cider vinegar than the common one of fermentation employed by the farmer?"

The same result may be obtained by much more rapid processes, but they are only profitable where large amounts are to be converted into vinegar. In his bulletin on the "Cider Vinegars of Pennsylvania," Dr. Frear thus gives two of these processes:

"In what is known as the 'Orleans process,' the barrel is partly filled with a mixture of old vinegar and cider; as soon as the acetification of the cider is complete, the speed of the oxidization being caused by the presence of the old vinegar, one-half of the mixture is drawn off and a fresh portion of cider is again added, and the process renewed.

"The Dutch process is a much quicker one. Vats are filled with thick shavings, whose surfaces are overgrown with vinegar ferment, receive trickling streams of warm cider from a tank above. These are met by a rapid current of air rising through ventilators about the bottom of the vat. The liquid dripping from the shavings is completely acetified. This process is employed in most large vinegar-making establishments. Whenever a high temperature or a rapid

current of air is used to hasten the process, it is always at the expense of part of the alcohol which is volatilized. The loss is often very considerable, sometimes fully one-third. Some loss attends every process, so that, although the theoretical yield is scarcely five parts of acid for four parts of alcohol, or eight parts of sugar, the actual results obtained in practice fall much below these figures."

"What is the cause, and what is the remedy for 'fire blight' in the pear tree?"

The cause is undoubtedly of bacteriological origin, and all other theories have been practically abandoned by those who have given careful attention to the subject. At one time it was attributed to the freezing of the sap during cold winters, and by some to decreased vitality, caused by the ravages of the borer.

Prof. Arthur has probably done as much as any scientific observer to establish the correctness of the theory that the disease is due to the presence of bacteria in the diseased tissues, and that its spread is due to the movement of these bacteria by natural causes, such as wind, rain, impregnated knives or impregnated tools of any kind; in fact, when we admit the correctness of this theory, we need not search long for a manner in which the disease may be carried from limb to limb, and from tree to tree.

Waite contends that it is an easy matter to start an outbreak of this disease by inoculating a few branches at the outside of the orchard, and allowing the bees free access; he claims that in visiting the flowers, these insects will carry bacteria, and thus rapidly spread the disease.

Prof. Sturgis states that anything that breaks the outer bark and gives the bacteria access to the soft tissue of the inner bark will convey the disease. He further states that the special bacteria which causes the trouble may be cultivated or multiplied very rapidly in infusions of hay, manure, garden soil, or even the cooked fruit of the pear itself, and that those thus produced will infect a tree if they are in any manner introduced into its softer tissues.

In discussing remedies, Prof. Sturgis writes as follows:

"1. Inasmuch as moisture and tissues in process of active growth are conditions peculiarly favorable to the development of the bacteria, we should look for the first symptoms of the disease in the spring, and especially in damp weather.

"2. We are justified in concluding that anything which tends to force excessive growth, or the development of tender shoots upon the limbs or trunk, tends especially to the inception of the disease.

"3. That open wounds of any description whereby the delicate tissues are exposed may give access to the germs of the disease.

"4. That the disease spreads outward from the locality first infected, in the direction of the prevailing winds.

"5. That the varieties making slow growth, and characterized by density of the tissues will be least susceptible to the disease.

"6. That the disease is mutually communicable between the pear, apple, quince and hawthorn."

As soon as the disease is noticed in an orchard, every diseased limb should be removed and burned; this should be kept up continually, regardless of the effect upon the trees mutilated, for if not done, its spread over the whole orchard is but a question of time.

Moist weather, attended by high temperatures early in the season, will often cause a rapid spread in an infected orchard; on the other hand, dry, cool weather will sometimes check an outbreak for a time.

"What can be done to avoid the present vexatious duplication of names of fruit?"

In an essay entitled "A Plea for Nomenclature," in one of the annual reports, J. A. Herr, member of the Board of Agriculture from Clinton county, proposed the following plan:

"1. Agricultural societies should offer premiums for no fruits (except new varieties), unless the correct name be given to the fruit on exhibition.

2. A committee on nomenclature at each fair should report the correct names of fruits on exhibition that are not correctly named, as far as possible.

3. Premiums should be given for the best map of an orchard, giving the correct name and place of every tree.

4. The State Agricultural Society, or the State Fruit Growers' Association, should institute a committee, and name a place to which samples of any fruit in the State may be sent, to ascertain the correct name, and to name new varieties of value.

5. Fruit dealers should insist that the proper names be given to the fruit they handle, thereby giving a market for the best varieties of fruit by their correct names.

6. Nurserymen should not accept the local and improper names so frequently given to well known varieties of fruit.

7. The National Fruit Growers' Society should endeavor to establish a common name for a certain kind of fruit, and discard all other synonyms.

8. Very many of our common and inferior fruits should be dis-

carded by nurserymen, and new varieties should be thoroughly tested before being generally disseminated, thereby reducing the number of names."

"Is growing rye injurious to peach trees?"

Yes; but the same charge may be brought against all crops; it is probably not because it is rye; but because it exhausts the soil of the material absolutely needed for the young and growing trees. While the trees are very young, a crop of rye will probably do no other harm than is caused by its exhausting the soil in the middle of the rows of the soil; food which the trees will eventually need; it is equivalent to producing two crops upon the same soil; one or the other must suffer from the competition which takes place; if the grain crop flourishes, it is at the expense of the young trees.

During the early life of an orchard, if the soil cannot be given up entirely to the trees, it is much safer to plant with potatoes or some root crop which, while it exhausts the soil less, also benefits the trees by the cultivation required to keep weeds in subjection.

We cannot find any evidence to prove that the rye crop is specially injurious to growing trees, and especially to peach trees, although we are aware that there is a prevailing opinion that there is something in connection with the cultivation of rye which injures the trees.

"One of the speakers this morning stated that peach trees but slightly affected by the yellows would ripen their fruit earlier for a year or two before the disease was noticeable in the leaves or branches; how may this fruit be distinguished?"

Dr. Smith writes: "These prematurely ripened peaches differ from healthy ones very materially in color. Once seen, they can never be mistaken. Generally, they have more color than healthy peaches, but essentially the difference lies less in the amount of color than in the peculiarity of its distribution. Instead of being delicately punctured with minute crimson dots, or imbued with uniform masses of color like the ruddy cheek of a healthy peach, the surface is closely blotched with red and purple spots of variable diameter, but usually not less than one-sixteenth of an inch across. These give the peach a mottled or speckled appearance, unlike that produced by any other disease, and so entirely different from the healthy appearance that the yellows might, in many cases, be diagnosed from a very small fragment of the skin of a single peach. Sometimes these spots are in-

frequent, sometimes they are very numerous. Usually they are somewhat sharply defined on a much lighter background, but sometimes they coalesce, giving the whole peach a dark crimson or purple color, or, more rarely, a brown purple or dull red."

"Will the production of strawberries pay near a good market?"

This may be answered in both the negative and affirmative and each answer be correct; it will and does pay some growers and it does not pay others. Like all other specialties it requires experience, care, careful selection of varieties and careful marketing.

We have known failures to result from the selection of varieties which have done well in another state or another and very different location; this is of course a failure not fairly chargeable to strawberry culture, and yet the proper selection of varieties is the primary and one of the most important steps in strawberry culture, and a mistake made here cannot well be rectified except by starting again and planting anew.

In making your calculations as to profits, do not take the large yields of successful growers as a basis; better divide them by two, for a fair average, and figure upon that. Men who have spent their lives at the business can obtain results far out of the reach of the amateur grower and many meet with sore disappointment by taking the maximum yield as their basis instead of taking the average one.

No one can give good advice as to varieties except it may be one in the immediate locality and upon similar soil; each soil has its own best varieties and each location has kinds which have in the past given satisfactory results to local growers; these are the ones to plant, and experiments with new varieties should be made carefully and to a limited extent only.

"In what manner does the law regulate the sale of cider vinegar?"

The act of 1897 provides as follows: "No vinegar shall be sold or exposed for sale as apple or cider vinegar which is not the legitimate product of pure apple juice, or vinegar not made exclusively of said apple cider, or vinegar in which foreign substances, drugs or acids shall have been introduced as may appear upon proper test, and upon said test shall contain not less than an acidity of four per centum and one and one-half per centum by weight of cider vinegar solids

upon full evaporation at the temperature of boiling water; no vinegar shall be branded 'fruit vinegar' unless the same be made wholly from grapes, apples or other fruits.

"Section 2. All vinegar made by fermentation and oxidation, without the intervention of distillation, shall be branded 'fermented vinegar,' with the name of the fruit or substance from which the same is made. And all vinegar made wholly or in part from distilled liquor shall be branded 'distilled vinegar,' and all such distilled vinegar shall be free from coloring matter added before, during or after distillation, and from color other than that imparted to it by the process of distillation. And all fermented vinegar, not distilled, shall contain not less than one and one-half per centum by weight on full evaporation (at the temperature of boiling water), of solids derived from the fruit or grain from which said vinegar is fermented. And all vinegar shall be made wholly from the fruit or grain from which it is represented to be made, and shall contain no foreign substance, and shall contain not less than four per centum by weight of absolute acetic acid."

"Is there any plan by which grapes can be successfully kept in a fresh state?"

The agricultural papers contain numerous plans for effecting this result, and reports indicate that there are none of them successful for any great length of time. One plan which is said to be one of the most successful, is to select only the soundest and best bunches, carefully dip the end of the stem in resin or wax and hang the bunches in a cool room so that they do not touch each other.

The California Experiment Station, in one of its reports, gives the results of several experiments in this direction, from which the following condensed summary is taken:

"In saw dust grapes kept well for a month but began to decay in six weeks, and at the end of two months were unfit for use. At all times those not injured by decay were seriously injured by a peculiar taste when taken from the saw dust, and the plan was not deemed as successful as that of hanging the bunches in a dark and cool room.

Grapes treated with alcohol vapor and sealed up in a box, the sealing having been done with paraffin, kept their appearance for five months At the end of nine months many had fallen off the stems and the white ones had turned brown. Those which were otherwise fit to eat were more or less injured by the taste of alcohol vapor. By dipping the bunches in a weak solution of sulphurous acid before exposing them to the alcohol vapor did not give much better results except that a lower percentage changed color.

Grapes which had been sterilized by sulphur fumes and then kept in an atmosphere of carbon dioxide kept well for nine months, but at the end of that time had moulded somewhat; those kept in an atmosphere of sulphur fumes were apparently in about as good condition as those treated with carbon dioxide, except that the black varieties turned brown."

In summarizing the experiment, the following language is used:

"These experiments, although in no case successful in preserving grapes in a perfectly marketable condition, are very promising and show that at least their appearance can be kept perfect. They show also the ease with which grapes, under the conditions in the experiments, took up odors, and the necessity of keeping them protected from anything that is liable to give then a bad flavor."

"What is the best method of getting rid of 'rust' on the raspberry?"

Raspberry rust is a fungoid growth, and will give way to a thorough application of Bordeaux mixture, properly applied. If once started with favorable weather, it will rapidly run over the whole patch and very materially shorten the crop. This growth appears to obtain its nourishment from the juices of the plant, and thus robs the forming fruit of the food which is absolutely necessary to its growth and existence. Spray with Bordeaux mixture as soon as you detect the presence of the earliest rust, and do not wait for it to spread.

"What is the remedy where fruit or shade trees are injured or mutilated in the construction of telegraph or telephone lines?"

The act of June 2, 1891, provides that when any one has sustained an injury in this way, he may appeal to the court of common pleas, the judge of which shall appoint three impartial citizens of the county who shall appraise the loss or damage sustained, and report the same to the court. If no appeal is made by the offending company, judgment may be entered against them for the amount of the damage as assessed by the viewers appointed by the court. The act also provides that these viewers shall receive the same pay per diem as is provided for road viewers.

"Is black knot in plums and cherries a fungous disease, or is it caused by insects?"

The presence of the minute worms which are sometimes found in the knots is the result of and not the cause of the disease. The diseased knot is a suitable and convenient place in which to deposit eggs, and several insects take advantage of it.

The disease is due to a species of fungus growth which is blown through the atmosphere from tree to tree, or carried by intermediate objects. The remedy is to destroy this growth by cutting off and burning all diseased limbs. This, if persistently carried into effect, and if neighbors have no diseased trees, will keep the disease in check for many years.

"Is 'Peach Yellows' communicated by contagion, and what is the remedy?"

Scientists are not fully in harmony as to the exact cause of this disease, but that it is, in the usual acceptation of the term, contagious, cannot be doubted. It may be spread or carried from a diseased to a healthy tree by the pruning knife, and many claim that it can be and is carried over the orchard by bees which go from the diseased to the healthy trees in search of honey or pollen.

The remedy is to remove and burn every diseased branch, and if the tree is badly affected, to dig it up and burn it. We have a strict State law for its eradication, but it is not noticed in any way, and we do not know of a single case in which it has been put in force.

"Can a producer of grapes make the surplus into wine and sell it without a license?"

The act of June 2, 1891, is entitled "An act to permit growers of grapes in this Commonwealth to manufacture wine from grapes of their own raising that are not first class or marketable, and sell such wine to licensed dealers without taking out or paying a license for such manufacture or sale."

The act is as follows:

"Whereas, Grape culture is becoming an important industry in many portions of the State;

And whereas, A certain portion of the grape crop is not first class or marketable, but can be made into good wine; therefore,

Section 1. Be it enacted, &c., That it shall be lawful for growers of grapes in this Commonwealth to manufacture wine from grapes

of their own raising which are not first class or marketable, and sell said wine to licensed dealers without taking out or paying a license for such manufacture or sale."

This law does not permit the sale of wine to any one, but confines the sale strictly to licensed dealers. As the law does not specify what are marketable grapes, the inference is that any wine made by the person who grew the grapes may be legally sold to any licensed dealer.

"What will prevent plums rotting on the trees when they are nearly ripe?"

The trouble alluded to is usually due to an unusual amount of wet weather which caused fungoid growths of different kinds and thus induces the trouble complained of. It is probable that the use of spraying mixtures which destroy fungoid growth might be of use, but we know of no experiments in this line. The damage is usually done before the fruit grower notices the first symptoms, and when it is too late to apply a remedy, even if a good one is at hand.

"A leeturer in his address alluded to the profits of drying raspberries. How is this done? What form of heat is used?"

Prof. Card, of Cornell, who has devoted considerable time to the investigation of the subject, thus answers the question:

"For a business of any considerable extent, by far the best way of drying is by means of some good evaporator. There are many different makes of these in market, most of which do good work. The hot air machines were first introduced and are still very largely in use. Later, steam came to be used and many of the large machines are now fitted for steam heating. These being newer are naturally said to be superior, and if they can be operated in connection with a plant where exhaust steam can be utilized, they undoubtedly possess an advantage. One of the points of superiority is the less liability to scorching with steam. From several years' experience with a large hot air machine, however, I do not think this point has much weight, for with any reasonable care, no fruit is scorched by either method. The temperature of the stack should run from 160 degrees to 180 degrees Fahrenheit. One very essential point in any machine, whatever the make, is a strong draft of air through the stack. The amount of vapor given off by a machine full of hot, green fruit is very great, and every possible facility is needed for carrying it away. The difference in the amount of fruit

which can be dried in a damp, cloudy day, and in a bright, clear day when the wind is in the northwest, emphasizes the point very strongly. In some of the large horizontal machines, it is necessary to secure this draft by means of large fans revolved by steam power. With many of the machines in use the fruit is put in at the lower end; the trays follow one after the other and can only be taken out at the opposite end, necessitating a two story building if it is an upright stack. This plan possesses the advantage of utilizing all the space in the stack; on the other hand, it possesses some decided disadvantages. All the trays must be carried down stairs or let down through the floor each time they are used, or carried back the length of the evaporator if it is a horizontal machine. Moreover, all the work must be timed and a tray put in just as often, otherwise it may reach the top too green and all operations must stop and wait till it is dry, or two or three trays must be put together and be sent through the whole length again with the chances that the first will then be dried altogether too much. If put in too slow, or if fruit is not coming in quite fast enough to keep the business going, it may be too dry when it reaches the top the first time. This is especially disadvantageous if it happens to be necessary to dry different kinds of fruit which do not require the same length of time in the evaporator. In a machine in which the trays are carried on hangers attached to an endless chain subject to the control of the operator, all this difficulty is done away. The trays are put in and taken out at the same place, and any tray can be brought around to the door and examined as often as desired and taken out when ready. In putting in fruit, one tray, only, is usually placed on a hanger at a time, so that in the natural course of the work every tray comes under the eye of the 'stackman' as often as it needs to be examined."

"Is fall or spring planting of fruit trees regarded as most advantageous and successful?"

There is a decided difference of opinion in regard to the above question. The location will, in a great measure, prove the controlling factor in arriving at a satisfactory conclusion. In cold climates, it is generally believed that the peach, plum, apricot, nectarine and other trees that produce fruit with pits or stones, will best bear transplanting in the spring. The majority of fruit growers prefer to plant apple, pear, quince and trees of a similar kind, in the fall season. When large trees of any kind are to be transplanted, it will

be best to do so when the ground is frozen, as it will adhere to the roots, and besides, supplying the tree with its original soil, it will also prevent the mutilation of the smaller roots of the tree. In a number of cases that came under the writer's observation, large trees were transplanted under such conditions without having indicated any change whatever of their transposition from one place to another, while under the ordinary or common method of transplanting, their growth would have been retarded, and in some cases, the tree would have been killed by injudicious treatment.

Forest trees of a reasonable size can also be successfully transplanted, if the tap root be severed about one year in advance of transplanting. The lateral roots will then grow more rapidly, extend their small, fibrous rootlets, and the tree will thus be better able to withstand the usually severe ordeal of transplanting.

"What is a fair yield per acre for black-cap raspberries under field culture?"

So much depends upon soil and culture that the question is a very difficult one to answer; if the question was asked of one hundred practical raspberry growers, it is probable that their answers would show a great difference in opinion.

Last season, Prof. Card, of Cornell Experiment Station, addressed a somewhat similar question to over 50 growers of berries, and his answers showed a great variation; the maximum was 9,600 quarts, and the minimum 576; the average of the whole number of replies, gave 2,493 quarts per acre.

A large grower in Illinois gave the average crop as from 2,400 to 3,000 quarts per acre; another stated it at 125 bushels; one gave it at "from 75 to 100 bushels."

The data furnished by Prof. Card is interesting, as it was directed at the business of drying the berries for market, for the information which it furnishes in relation to the drying industry, which has become quite a source of profit in New York state.

Upon this special point, Prof. Card writes thus:

"Basing an estimate upon the above figures, we may look for 750 pounds of dried fruit (black cap raspberries), per acre, with good management. It is safe to say, that this product, through a series of years, will average at least twenty cents per pound, making a gross return of $150.00 per acre, from fields in full bearing. The cost of harvesting and marketing may be summed up at about as fol-

lows: Harvesting, at half a cent per quart, $12.50; evaporating, at two and one-half cents per pound, $18.75; cleaning for market, at one cent per pound, $7.50. This leaves a little over $100.00 for rent of land, cost of growing and profits."

"Is it not a fact that growers of fruit in New York, Michigan and other leading apple-producing states use fertilizers liberally, and that the fertility of the orchards of this State is frequently ignored and neglected?"

Apples, like any other crop, exhaust the soil, and unless this lost fertility is replaced, exhaustion will surely follow. If the experiment is fairly tried, it will be shown clearly that the fruit from a properly fertilized orchard suffers less from the attacks of insects, is more highly colored, is greater in quantity, has less culled fruit, and returns the best dividend upon the outlay.

Experiment has also demonstrated that phosphoric acid and potash are the two ingredients most needed in the orchard, and that it is safest to avoid nitrogenous manures which are likely to produce a large amount of soft wood, which, especially in short seasons, will not mature, and which will be more or less winter killed.

Analyses and experiments appear to demonstrate that potash, of all the special fertilizers, is best adapted to the wants and needs of the orchard, and that its application will pay. Just how much, and in what form, can only be determined by accurate experiments, but that its application in the form of wood ashes, will pay, has been clearly established.

There can be little doubt that the orchard will pay for the fertilizers even more liberally than the ordinary crops of the farm, and that not only the quantity, but also the quality of the crop is affected by them.

"Who owns the trees, fruit or grass growing along or in the public road?"

The owner of the property which abuts on the road upon the side upon which the material in question grows; the only exception to this is in case where the whole of the land occupied by the road was

taken from one individual, and in that case he owns all the crop of any kind growing along the road.

The public have nothing but the right of way over the road; they have no right in the land, and anything that grows upon this land is just as much the property of the owner of the adjacent land as are the crops growing upon the inside of his fences; he merely gave the public a right of way over the land, and if he received damages, it was for the loss of the use of the land, and not the loss of the land itself; for if for any cause the road is discontinued, the land reverts to the farm or lot from which it was taken.

A case which is often quoted to prove this point, is that of Cole vs. Drew (44 Vt. 49). The children of Drew, in passing along the road to school, were incommoded and their feet became wet by contact with the grass which grew upon Cole's side of the road. Drew applied for and obtained the permission of the supervisors to cut the grass, and had he stopped there, there would have been no case against him; but he carried the cut grass to his barn, and fed it to his horse. Cole entered suit, and recovered damages to the value of the grass taken away.

Based upon this case, it follows that no one, except the owner of the land taken for the road, has the right to pasture cattle or stock upon the public roads. The supervisors may either of themselves or by deputy, cut the grass, if it incommodes public travel, but they cannot legally use or give it as food for stock.

In the case of Overman vs. May (35 Iowa, '89), it was held that though the supervisors might quarry stone in the road, they could not haul or use this stone for the repair of another road; the stone must be used upon the road from which they were taken.

It may, then, be safely asserted that grass, fruit, trees or other valuable material along the side of a public road belongs to the individual to whom the land would revert in case the road was, from any cause, discontinued.

DISEASES OF ANIMALS.

"Are there any well authenicated cases upon record to prove that tuberculosis, or tubercular consumption, may be acquired by the human family by the use of meat or milk from tuberculous animals?"

After fifteen years practical experience with tuberculosis in animals, we have yet to find a case, within our observation, which can be stated to have been caused by the use of the products of tuber-

culous animals, and yet we are firmly of the opinion that such transmission is possible, and that, under certain circumstances, it does take place. It is however, quite certain that milk from tuberculous cows will transmit the disease to pigs to which it is fed, and there is good reason to believe that rats fed on tuberculous meats will contract the disease.

The inference is, that if animals may thus contract the disease, the human family may be infected in the same way, and the best authorities upon the topic of the transmission of contagious disease, admit the possibility of the transmission of consumption from the animal to the human being.

There is, however, much misapprehension as to the transmission of this and other diseases. There is no doubt but that the bacilli of consumption are at all times floating in the air, and that every member of the human family daily takes them into his system in the air which he breathes, but if he is healthy and his lungs in a sound condition, no harm ensues and the tubercle does not effect a lodgment. But, if, on the other hand, there be a predisposition to the disease from hereditary taint, the tubercle, finding the necessary surroundings, effects a lodgment, multiplies, and we have a case of consumption and death.

But, if, as stated, the system is in a healthy condition and the lung surfaces all in a healthy condition, no harm is done by the passage of the tubercles through the organs of the body which they reach.

Nor can we assume that this transmission is made through the lungs only; they may be, and often are, taken into the system with food and water, and the effect and the rules governing their transmission are exactly the same as those governing their movements when taken in with the atmospheric air. If the organs which they reach are sound and in good condition, no harm follows, as they appear only to be able to effect a lodgment and grow when surrounded by certain conditions, which, fortunately for the human race, do not always exist. If we accept the germ theory of the propagation of the disease, and add to it the usual statements of the newspapers as to the transmission of tubercular diseases, we will readily see that, if the theory in its extremes, was correct, there should be no members of the human family alive in our cities to-day. If every tubercle which obtained entrance into the human body effected a lodgment and formed a centre for the propagation of tubercles, all would, in a short time, be infected.

The writer has superintended the killing of an entire herd of twenty-seven cows, all of which were found infected with the tubercles of this disease, and part of the milk of which had been consumed

in a family of growing children, and yet the children and family were perfectly healthy. This can only be accounted for upon the theory that the tubercles did not find congenial or suitable material for a lodgment, and passed harmlessly through the system.

"Should the State pay for glandered horses killed to prevent the spread of the disease?"

Inasamuch as it may be assumed that a glandered horse is a public nuisance, and, therefore, has no value, we might answer the question in the negative, and yet, after many years' experience in the condemnation and killing of animals having contagious diseases, we unhesitatingly answer that the State should pay for animals destroyed by State authority, and to prevent a further spread of a contagious disease; and we base this answer not upon the exact justice of the decision, but upon the broad ground of public policy and public economy. We have invariably found, that if a reasonable compensation is assured to the owners of animals suffering with contagious and dangerous diseases, they will report them, and neighboring stock may be saved. We give this as the result of practical experience, and we have always advocated that the State should pay a low price, in order to induce the owner to report the case and consent to the destruction of his property.

A horse affected with glanders in a chronic form is valuable to his owner, because he is good for many years work with but reasonable care, and has, therefore, a value.

The question resolves itself into this: The State has decided to eradicate certain diseases; it is proper that it should be done with the least possible expenditure of funds; one of two plans must be adopted; the State must employ and pay veterinarians to hunt the disease up and destroy the animals, or, it may, by the payment of a small compensation to the owners, make it to their interest to report the same; which is the most economical? This question being answered, will also answer the question proposed at the institute. Our experience has always been that it is far more economical for the State to remunerate the owner than to incur his ill will, and be compelled to employ officers to hunt up the cases, and to kill the animals against the wishes of their owners.

In the work of eradicating contagious pleuro-pneumonia, no animals were killed until the owners were satisfied with the price of-

fered them; and in no case did the State officers have any trouble in arriving at a solution which was not satisfactory to all parties interested.

The result of the work in our State, as compared with similar work in other states in which no compensation was given, clearly proves the economy and wisdom of allowing the owners of such animals a small amount for stock destroyed.

We admit the rights of the State, under police law, and the law of protection for the many, although the few may suffer, but at the same time we are satisfied that it is economical to pay for animals killed for the benefit of the public.

"What length of time is usually required to develop cases of glanders?"

The period which elapses between the inoculation and the full development of the disease will depend upon a variety of circumstances, among which we may enumerate the following: The condition of the animal infected, the circumstances which surround the animal, the treatment which the animal receives, the amount of work performed by the animal between the period of inoculation and the development of the disease, and the character of the food given to the animal.

If the animal is in low condition and has been partially starved or fed upon innutritious material, the case will develop most rapidly; if the animal is kept in a poorly ventilated stable, or if kept warm and in close confinement, a rapid development may also be expected. If the animal is worked hard between the two periods, a more rapid development will follow; the rapidity of the development is also increased by a want of exercise and high feeding.

It is also claimed that the rapidity of development bears some relation to the character of the matter which caused the infection, and that an animal infected by the discharge from an animal in the advanced stages of the disease, will develop it more rapidly, and that if the infection comes from an animal in the earlier stages of the disease, the development will be slower.

In cases upon record, an animal, for the purpose of experiment, was inoculated April 25th, and was dead May 5th; on the 28th the discharge was plainly visible in one nostril; the temperature had risen to 101.2 and the pulse to 66. May 1st the temperature had gone up

to 103 and the pulse 52; May 3d the temperature was 105.6 and the pulse 62.

The experience of the officers of the Board is that the surroundings and care of the animal have much to do, not only with the character, but also with the development of this disease; if a glandered animal is shut up in a tight stable with other horses, the chances of the spread of the disease are greatly increased. Where the animals are well fed, have reasonable exercise and plenty of fresh air, the chances of infection are not only reduced to a minimum, but the character of the disease appears to be modified and its virulence decreased. As a proof of this, it is found that a glandered horse running among animals treated as farm horses are usually treated, will do comparatively little harm, while had the same animal been confined in one of the large stables used for city livery horses, the loss by infection would have been very great.

No matter how light the development of the disease may be, the infected animal should at once be destroyed, for it can never be safe; what is often termed a "cure" may be effected, or nature may, for a time cover up the trouble, but it is liable to again return with any disarrangement of the system, but it is liable to again return with any safe course.

As before stated, the length of time which will elapse after the inoculation has been completed, and the death of the animal, will depend upon surrounding circumstances. In cases in which useless animals have been inoculated with the virus from cases of glanders, in order to prove beyond doubt the existence of the disease, the symptoms can readily be detected at the ninth day after the operation, and in many cases even sooner; in some cases, death has been produced in ten days after the introduction into the system of the virus.

"Is a special examination required for the practice of veterinary surgery and medicine in this State?"

The act of May 16, 1895, creates the State Board of Veterinary Medical Examiners, and section 6th of the law carries with it the following provision:

"The said Board of Veterinary Medical Examiners shall examine all diplomas as to their genuineness and each applicant for a license shall submit to a theoretical and practical examination, said examination to be written, oral or both. Such examinations shall include the following subjects: Veterinary anatomy, surgery, practice of med-

icine, obstetrics, pathology, chemistry, veterinary diagnosis, materia medica, therapeutics, physiology, zootechnics, sanitary medicine, and meat and milk inspection."

To such as pass this examination the Board is authorized to issue certificates or licenses to practice in the State, and a record of all such licenses issued is to be kept in the office of the Board.

The fee for such a license is ten dollars, and in addition, all applicants must register at the office of the prothonotary of the county in which they expect to practice and pay a fee of one dollar.

The act exempts from its provisions all those who carry the practice of veterinary surgery no further than the castration of animals, and also exempts all who treat animals without charge.

"What is the cause of anthrax, and how is it spread from animal to animal?"

Dr. Law, in his "Farmers' Veterinary Adviser," gives the following as among the prominent causes of anthrax:

"1. By the rich surface soil abounding in organic matter, and the impervious subsoil preventing natural drainage.

"2. The frequent inundations of the banks of rivers flowing through a level country, and the drying up of ponds and lakes, leaving much organic deposit in their basins.

"3. A continuation of warm, dry weather, which favors organic emanations from such places as the above.

"4. A condition of the system of the animal predisposing to the reception and growth of poison, and consisting in loading the blood with plastic or waste organic matter, as in over-fed, plethoric animals; in those taking flesh most rapidly; in the young and growing; in those rendered unhealthy by over-work, impure air, unsuitable food or water.

"5. Sudden chills when the poison is already prevalent; hence, extreme variations in temperature of night and day produce it.

"6. A close, still atmosphere."

Of the manner in which it spreads from animal to animal, the same authority writes as follows:

"It is propagated by contagion, but tends to die out when produced in this way alone. It is transmitted by contact with the blood, liquid exudations, portions of diseased carcasses, fat, hair, wool, feathers and bowel evacuations, and rarely, or not at all, through the atmosphere. Simple contact of these matters with the healthy skin of a susceptible subject, is enough to produce the disease.

The virus is most potent when received from an animal still living, or only recently dead, and yet may be preserved for months in all conditions of climate, temperature and humidity."

"Is tuberculosis (tubercular consumption) in animals transmitted by sire or dam to the progeny, by hereditary taint?"

It is an admitted fact that the progeny of a tuberculous sire and dam, or if either are tuberculous, will die with tuberculosis; the exceptions are so rare that they practically prove the rule. If both sire and dam are infected, the danger is intensified, and the disease will overtake the progeny earlier in life.

It has been stated by some, that it is erroneous to claim that tuberculosis can be transmitted in this way, and that the progeny of tuberculous animals are diseased from the transmission by contact after birth, and that if the sire alone is diseased, the chances of the progeny escaping the disease, are greatly multiplied.

Our observation convinces us that the latter claim is correct, but, as it is admitted that the disease may be transmitted through the milk from dam to progeny, it follows that the progeny of a tuberculous cow has an extra chance of obtaining the disease through its mother's milk, and that the progeny of a healthy cow by a tuberculous bull, has not this opportunity of infection.

But practical observation shows that it is not necessary to wait until the progeny has an opportunity of contracting the disease through either the milk or the breath of its parents, or by eating material upon which other infected animals have breathed. We have found, when pregnant, diseased cows have been killed, that the unborn calf was infected, and, in many cases, seriously diseased. In such cases there would appear to have been room to assume that the transmission was by hereditary taint.

In such cases as have come under the observation of the writer, both parents have been more or less affected with tuberculosis, and hence, the disease being already in the system of the dam, may have been transmitted to the calf through the blood of the mother, which inter-circulates through the bodies of both.

To prove the case of hereditary transmission clearly, if the dam should be sound and the sire diseased, and if in such case, the unborn calf is found diseased, it is reasonable to infer that the disease must have been obtained through hereditary taint from the sire; the writer, however, knows of no such cases, and until we have them, we shall probably have to assume that it is merely the predisposition to the disease which is transmitted.

"Is mallein a safe agent for the detection of glanders in horses?"

The use of mallein as a diagnostic agent for glanders does not appear to be as well understood and endorsed as is the use of tuberculin for tuberculosis. In the work of the State Board of Agriculture, it has been repeatedly used with excellent success; in one case, in an outbreak among the animals in a large livery stable, its use enabled the State officers to conquer the disease in much less time and with much less loss to both the owner and the State, than would have been possible without it.

Its effects are probably best described by Resueil, as follows:

"1. The injection of mallein into a glandered horse causes (a) an elevation of temperature of two degrees and over; (b) local symptoms at the point of inoculation; (c) an organic reaction, manifested by trembling, stiffness of the membranes, loss of appetite, etc.

"2. The elevation of temperature follows an ascending course, until toward the eighth hour; it attains its maximum from the tenth to the fifteenth hour, and remains stationary until the thirty-fourth hour. The return of the normal temperature is very slow.

"3. The thermic curve generally does not affect the regular descent; it may present temporary elevations in its downward course.

"4. The local swelling, more or less sensitive and extensive, lasts for more than thirty-four hours.

"5. The organic reaction is more marked as the disease is more advanced; at the commencement of the disease, it may pass unperceived.

"6. If the elevation of temperature is only one and one-half degrees, the horse should be considered healthy; when from one and six-tenths to two degrees, he is suspected, and should be submitted to a second injection.

"7. The hyperthermia and local symptoms may be observed in non-glandered horses, but these manifestations are temporary and little marked, and after thirty-four hours, all trace of the injection has disappeared. In order to avoid errors of this kind, the temperature should be taken during the fifty-eight hours following the injections.

"8. In a glandered horse, injected several times in succession, the reaction is augmented in ratio with the dose of mallein.

"9. The thermic reaction is little marked in those cases in which there is already a rise of temperature. It is better than to postpone the injection, or to depend more upon the local phenomena."

"In his remarks this morning in relation to tuberculosis, Secretary Edge alluded to the possibility of immunity of some animals; what did he mean?"

It is well known that in all disease caused or produced by germs the different classes of animals are not only affected differently, but that they are liable to infection in very different degrees, and it is also well known that some germ diseases are practically confined to certain kinds of animals. Of this we may instance the disease called contagious pleuro pneumonia; this was confined to cattle, and horses were never known to be affected by it; goats were affected but pigs were not; rabbits were liable to it, but many other classes of animals were in some manner protected from it. Although not admitted by all, yet practical evidence seemed to prove that animals which were once infected by this disease and had recovered had in some manner obtained an immunity and were not subject to re-infection.

Not only does a change in the character of the animal appear in some cases to confer immunity, but even among those which are liable the infection takes place to a variety of degrees. Thus, Prof. Nelson writes: "The number and strength of the germs that enter at once or the frequency with which the infection is repeated, as related to the power of the body to resist invasion, is important. The rabbit, for instance, not so susceptible to tuberculosis as the guinea pig, will usually not become tuberculous if the germs that are inoculated have been heated to 140 degrees F., or if they are fewer in number than 150."

When it is remembered that simply raising the temperature to 150 degrees for a short space of time will not destroy the germs so as to prevent infection of the human and bovine races, this variation becomes apparent and plain.

In referring to another source of immunity, Prof. Nelson writes as follows:

"In the case of several diseases (questionably so with tuberculosis) recovery from one attack confers immunity against a subsequent attack. If the blood of an immune animal is inoculated into a susceptible one it will render the latter immune. When a patient recovers from a disease it is supposed to be due to the fact that his tissues have manufactured an antidote to the bacterial poison, or a counter poison called anti-toxin, which has a repressing or attenuating action upon the germs. By cultivating germs under artificial conditions, they become so changed as to make a weakened poison. These 'attenuated' germs, when inoculated or vaccinated into the animal, produce a mild form of the disease, under the stimulus of which the body acquires immunity against stronger attacks."

"Have not the surroundings and ventilation much to do with the spread of tuberculosis?"

Of course, this disease cannot be created; the germ must first exist, but its existence does not necessarily mean the infection of all the animals in the herd. If the surroundings are perfect, if ventilation is good, if the animals are well fed, it is possible, in very many instances, in fact in a majority of them, that the vitality of the animal may throw disease off, but if, on the other hand, the stables are dark and poorly ventilated, if the animals are scantily fed or if fed upon an improper kind of food, the disease, even under similar circumstances, may and usually will spread with great rapidity.

One of the worst outbreaks which came under the care of the Board of Agriculture was one in which the animals were fed on the best food that could be procured; were curried once each day and some of them were milked three times; the stables were warm and comfortable, but all ventilation, during cold weather, had been cut off by closely stopping up the funnels, windows and doors.

In alluding to the recent attempts of Count Wedell, of Denmark, to clear his herd of this disease, the London Field has the following:

"Mr. Wedell is following in the wake of Prof. Bang's teachings; he is determined that his herd shall be composed of animals that are free from the disease; he recognizes the danger to the farmer of loss; it may be ruin, which follows on the spread of tuberculosis, yet he resides upon a thinly inhabited island. Out of something like 300 head of his cattle, a large proportion have reacted after the tuberculin test; in other words, the rise in temperature has shown that they were infected with the disease, insignificant as in many cases the lesions may be. The animals which react are not slaughtered or sold, but are simply housed apart, fed by separate sets of men and grazed on separate fields. The tests are made twice each year, and Count Wedell has every hope that by following this plan unremittingly, he will, in a few years, be able to show a clean bill of health."

Prof. Bang's theory is that, even after the animal has been actually infected, it may throw off the disease if kept in the open air, with good food and care. If this is correct, and the evidence at hand indicates that it is, it is very evident that ventilation has much to do with not only the spread of the disease, but also with the infection.

"Is there no remedy or cure for tuberculosis?"

A satisfactory answer to this question is very difficult; our thinking men in this country and in Europe are arriving at the conclusion that there is no remedy, that much might be done in the line of prevention, and that, instead of large expenditures for animals killed, it

might be profitable to test the matter of preventing and possibly the cure of light cases. It will be remembered that the use of tuberculin for the discovery of the disease originated in the experiments and tests of Koch, who claimed to be able to cure the disease by injections of the tuberculin. This did not prove to be the case, but the evidence now adduced shows that there was in reality more in Koch's theory than has been supposed, and experiments tried for that purpose appear to demonstrate that repeated injections of tuberculin will encyst the tubercules and render them harmless, at least for the time being, if it does not in reality cure the disease.

The members of our State Live Stock Sanitary Board have been so much impressed with this and other facts brought out by carefully conducted European experiments that they, at the last session of our Legislature, asked for and obtained an appropriation for the purpose of making a careful test of the means of prevention and possibly of cure (should there be such found), and experiments are now under way for the purpose of ascertaining what there is in the various theories which have been developed within the past year.

It is evident to all practical dairymen that the treatment which we now accord to our cows is well calculated to cause heavy losses from this disease, and that while no one can, for any length of time, claim that bad sanitation cannot cause the disease, yet it is undoubtedly the fact that bad sanitary surroundings are responsible for much of the loss now overtaking our dairy owners. Bad ventilation, high feeding, constant milking and the unnatural condition in which our cows are kept certainly have much to do, as all the members of our Stock Board fully believe, with the present condition of affairs, and it is their intention to see what the effects of the best sanitary surroundings will have upon slight cases of tuberculosis, and they hope to be able to show conclusively that with animals of high value at least, it may pay to isolate them and give them the best possible opportunity to throw off the disease.

"What connection is there between the ticks and the Texan fever?"

That there is some connection between the ticks sometimes found on cattle affected with Texan or southern cattle fever and the fever itself, is undoubted; but just where and how this connection is to be made is by no means so clear. The United States Department of Agriculture, under the special direction of Dr. Salmon, has been conducting experiments for several years, and in one of their recent reports thus state their conclusions:

"The hypothesis which seemed most plausible after the experiment

of 1889 was that the tick, while withdrawing blood from the southern cattle drew out in it the Texan fever parasite, which, entering into some more resistent state, perhaps some spore state, was disseminated over the pastures when the body of the mother tick became disintegrated. These spores were then supposed to enter the alimentary tract with the food and infect the body from this direction. The latter experiments completely demolished this conception. Neither the feeding of adult ticks and tick eggs nor the feeding of grass from infected pastures gave any positive results. On the other hand, the unmistakable outcome of the experiments was that the young tick introduced the infection into the body. This fact implies two possibilities. Either the tick is a necessary or a merely accidental bearer of the micro-parasite. If a necessary bearer of the infection, we must assume that the latter undergoes certain migrations and perhaps certain changes of state in the body of the adult tick, and finally becomes lodged in the ovum. Subsequently, it may become localized in certain glands of the young tick and discharge thence into the blood of cattle. This hypothesis assumes a complex symbiosis between the tick and the parasite on the one hand, and the cattle and the tick on the other. According to another simpler hypothesis, the tick would be merely an accidental bearer of the infection. The parasite entering the body of the tick with the blood of the cattle may be already in the spore state or about to enter upon such a state. The young ticks, as they are hatched near the body of the female, may become infected from this. This infection, clinging to their mouth parts, is introduced into the blood of the cattle to which they subsequently attach themselves. Further investigations are necessary before the probable truth of one or the other of these hypotheses can be predicated with any degree of certainty."

"In his address this morning, Secretary Edge alluded to the dangerous character of glanders; what are its symptoms?"

Circumstances and surroundings somewhat modify the symptoms of this disease; symptoms which might be correct for low and illy ventilated stables would not be recognized in cases in which the animal is more or less exercised in the open air; symptoms which might be correct for a poorly fed and neglected animal might not be recognized in one well cared for and fed.

Dr. Williams thus describes the symptoms of the disease:

"The disease, preceded by increased temperature of the body, appears suddenly, ushered in by rigors, sometimes of the most persistent character. In one case which fell under my notice the rigors continued without intermission for three days and nights, at the end of

which time a sanguineous discharge issued from both nostrils, the Schneiderian membrane became violently inflamed and deeply ulcerated. More commonly, however, the rigors are not so persistent, but they are always more or less observable; the temperature is sometimes as high as 106 and even 109 degrees; the breathing is accelerated, the pulse feeble, rapid and even dicrotonous; the heart's action palpitating and accompanied by a metallic tinkling; the appetite fails, the pituitary membrane, at first of a dark copper color, with patches of ecchymosis of a dark red hue, becomes purple and patches are rapidly converted into pit-like ragged edged ulcers from which issues copious sanious discharges. The eyes are weak and discharge issues from them; the nostrils are often swollen. The breathing is hurried, irregular and impeded by the swelling of the nostrils and by glutinous discharges drying around them; abscesses speedily form along the course of the lymphatics of the face; the urine is pale and increased in quantity."

"What is the primary cause of the disease known as anthrax?"

It may be caused by quite a number of causes, but first of all they must have the germ which gives it its peculiarities; this being absent, we are to assume that the disease will not exist.

In referring to the causes which induce the rapid increase in the germs which characterize the disease, Prof. James Law writes as follows:

"It is propagated by contagion but tends to die out when produced in this way alone. It is transmitted by contact with the blood, liquid exudations, portions of the diseased carcasses, fat, skins, hair, wool, bristles, feathers and bowel excretions, and rarely or not at all through the atmosphere. Simple contact of these matters with the healthy skin of a susceptible subject is enough to produce the disease. The virus is most potent when received from an animal still living, and only recently dead, and yet may be preserved for months in all conditions of climate, temperature and humidity."

The same authority states that the development of the disease is determined:

"1. By the rich surface soil abounding in organic matter and the impervious subsoil preventing natural drainage.

"2. The frequent inundation of the banks of rivers flowing through a level country, and the drying up of ponds and lakes, leaving much organic deposit in their basins.

"3. A continuation of warm, dry weather, which favors organic emanation from such places as the above.

"4. A condition of the system of the animal predisposing to the re-

ception and growth of the poison, and consisting in loading the blood with plastic or waste organic matter, as in overfed plethoric animals, in those taking flesh most rapidly, in the young and growing, in those rendered unhealthy by overwork, impure air, unsuitabe food or water.

"5. Sudden chills when the poison is already prevalent; hence, extreme variations in temperature of night and day.

"6. A close, still atmosphere."

The outbreaks which have come under the care of the Department have, in many cases, been caused more or less directly by long spells of dry weather which had dried up the ponds at which the stock usually obtained water or which had so reduced the volume that the remaining water reaches a high temperature during the warm portion of the day.

In most of the cases the outbreak has given way on the removal of the animals to high and drier pastures, with pure water and less succulent grasses.

MISCELLANEOUS TOPICS.

"Is the owner responsible for damages done by an animal known to be vicious?"

Hon. George W. Hood, of the Indiana bar, an ex-member of the Board of Agriculture, replies to a similar qustion as follows:

"It is generally understood that if a man turns his animals loose upon the highway, and they injure either the person or the property of another lawfully using the way, the owner is responsible for all damages they may do, whether he knew they were of a dangerous disposition or not. The owner of a vicious animal is bound to confine it, as respects the public; but under special circumstances, the question whether one who knew the animal's propensities, was guilty of culpable negligence, shall be left to a jury."

"In one instance, a man let a horse go out to feed in a public place where some very young children were playing, and some of them began to switch him, whereupon he turned and kicked one of them so that he died; and the owner was convicted of manslaughter. It might have been well for that man that the Mosiac law was not then in force, because, under that law it is declared 'that if the owner of an ox knew that he pushed with his horns, and did not keep it in, and it killed a man or a woman, not only the ox, but also the owner, was put to death.' The owner is liable for injury done by an animal which is known to be fierce or dangerous, and where such an animal is the joint property of two persons, one of whom allows others to have charge of it, both are liable to the person injured."

"An instance in the state of New York is reported where a farmer, who was much annoyed by strolling fishermen, put a savage bull into a lot along the stream. Some of his neighbors remonstrated with him and stated that he ought to give the fishermen notice what kind of an animal he was, but he replied that 'the fellow would give them notice enough himself;' and true enough the fellow did give notice when the opportune time came, and the result was two broken ribs, which cost the farmer five hundred dollars.

"It is well understood that there are some vicious animals which are with great difficulty controlled at all; and where the farmer strives to keep them on his premises, and within a properly fenced enclosure, and gives notice to the public that a dangerous animal is enclosed therein, I think he can in no way be held responsible for any mischief they may do."

"Has there been a decrease in the amount of the annual rainfall during the past fifty years?"

There does not appear to be any evidence to prove that the annual rainfall has changed materially during the past fifty years; records for the past sixty-six years, published in the annual report of the Board of Agriculture for 1893, show, if they show anything, an apparent increase in rainfall.

Dividing the records of the 66 years into periods of 5 years each, the first one shows a rainfall of 41.47 inches, while the last period gives one of 51.62 inches; when the 66 years are divided into periods of 10 years each, the first one indicates a rainfall of 41.20 inches, while the last one shows a fall of 49.63 inches; but it should be noted that the last period has within it the rainfall which caused the Johnstown flood, and which was phenomenal all over our State; during that year the total annual rainfall was 65.05 inches; if this unusual fall is left out of the calculation, the rainfall of the last period of ten years will amount to 41.25 inches. The average rainfall for the 66 years, in periods of 5 years each, is 43.81 inches; for periods of 10 years each it is 44.08 inches; and for averages by years, it is 43.74 inches.

All observations tend to prove that the average rainfall of any section of our State has not decreased, but that the distribution of this rainfall has been materially interfered with and altered; that while the same amount of rain falls as formerly, it is much more unevenly distributed, and that this unevenness of distribution is becoming more and more evident as we clear away our forests, and permit the rainfall to at once run off into our streams. We think

that if the exact amount of water which annually passes down our rivers and streams could be measured, it would be found not to vary materially from that which passed down the same streams fifty years ago; the difference being that it now rushes down with every rain, and is not held back as formerly by a coat of leaves and the shade afforded by the woods which have recently been cleared off.

All records, so far as we can obtain access to them, fail to show any diminution in the amount of our annual rainfall, and this opinion is arrived at after careful examination for a number of years.

"How far apart should drains be dug?"

No definite rule can be laid down, as very much depends upon their depth and the character of the soil through which they run. It must me remembered that the tendency of the surplus water to go into the drain is retarded by the capilliary attraction of the soil, and that this attraction varies in different soils. Drains, of equal depth, may be placed much nearer together in loose and sandy soils than in stiff clays, and much further apart with deep drains than with shallow ones.

In some districts the practice prevails of putting the sub-drains in at double the supposed necessary distance apart, and then, if it is shown to be required, place another drain between each pair. We think, however, that practice will prove that it is best and most economical to lay the drains at proper distances apart at first, and not trust their drawing the longer distances.

In ordinary soils it is safe to estimate that each foot in depth will permit ten feet between the drains, and that if three feet drains would work satisfactorily at thirty feet apart, four feet ones may be put forty of fifty feet from each other.

The writer has laid numerous drains in such soils as are ordinarily found on our farms, and found thirty feet to be a satisfactory distance apart; but he also laid them where thirty-five and forty feet, in a looser soil, gave quite as good results. Some have laid it down as a general rule that the drains should have a distance between them equal to ten times their depth, but it has been clearly proven that in soils of average density and ability to hold water, this rule may be safely exceeded.

Both depth and distance apart are, in a great measure, governed by the cost of digging; it is often the case that in difficult digging, a less depth and less distances asunder will prove most profitable. In fact, the integers governing are the ease of digging, the character of the soil and the cost of the tile. It may be more economical, with

high priced tile, to put more expenses upon the digging and go deeper, and thus possibly by an extra depth of eighteen inches, save the expenses of one line of tile.

In practice it will be found that an extra foot in a drain two feet deep, will permit the addition of more than ten feet to the distance apart, for the lower foot has the power to "draw" the water further than has the upper or first foot of depth.

As a general rule, we may assume that ditches two and one-half to three feet deep, may be placed thirty feet apart, and they will be found to drain any but very stiff and clayey soils.

"Secretary Edge, in his address this morning, alluded to the use of electricity in the production of early vegetables; has it proven profitable, and what are its effects?"

Mr. Rawson, member of the Massachusetts Board of Agriculture, from the Arlington district, answers this question, after a large amount of practical experience, in the affirmative, and is proving his belief by constantly increasing the area of glass devoted to this purpose.

His experience is mainly confined to early cucumbers and early lettuce, and, from experiments tried elsewhere, it appears quite probable that its use for these crops yields a greater profit than upon any other two which can be selected.

At the Cornell Experiment Station, Prof. L. H. Bailey has, by very careful experiments, tested the use of electric light for the production of hot-house crops of various kinds, and, after carefully summarizing the results of all of his experiments, he arrives at the following conclusions:

"(1). The incandescent electric light has a marked effect upon greenhouse plants.

"(2). The light appears to be beneficial to some plants grown for foliage, such as lettuce. The lettuce was earlier, weighed more, and stood more erect.

"(3). Flowering plants blossomed earlier and continued in bloom longer under the light.

"(4). The light influences some plants, such as spinach and endive, to quickly run to seed, which is objectionable in forcing these plants for sale.

"(5). Proper watering appears to be more important with radishes, beans and cuttings than improper watering and the electric light.

"(6). The stronger the candle power, the more marked the results, other conditions being the same.

"(7). Most plants tended toward a taller growth under the light.

"(8). It is doubtful whether the incandescent light can be used in the greenhouse from a practical and economical standpoint on other plants than lettuce and perhaps flowering plants, and at present prices it is a question if it will pay to employ it even for these.

"(9). There are many points about the incandescent electric light that appear to make it preferable to the arc light for greenhouse use."

"What solution can be used to kill the scab on potatoes for planting?"

Mr. Terry states that he uses corrosive sublimate at the rate of two ounces to fifteen gallons of water, letting the potatoes down into the mixture in an old fertilizer bag, and allowing them to drip well before they are emptied out to dry. More corrosive sublimate and water may be added from time to time. The potatoes should remain in the mixture some time in order to ensure that all the spores of the scab have been killed. If there are spores in the soil in which the potatoes are to be planted, this plan will not eradicate them.

"What is the 'fifth or butchers' quarter,' to which Secretary Edge referred in his address this morning?"

The term "fifth or butchers' quarter," is usually understood to refer to such parts of the beef as are saleable or used for food, and not contained within the four quarters as they are usually dressed for market.

To illustrate, we give the following table, showing the weights of the various portions of a beef weighing, when alive, 825 pounds:

Live weight,	825.	pounds.
Blood,	42.	pounds.
Hind quarters,	222.	pounds.
Fore quarters,	242.	pounds.
Heart,	3.94	pounds.
Liver,	7.75	pounds.
Spleen,	2.37	pounds.
Lungs,	8.75	pounds.
Small intestines,	16.50	pounds.
Large instestines,	19.00	pounds.
First stomach,	50.00	pounds.
Second stomach,	2.56	pounds.

Third stomach,	5.75 pounds.
Fourth stomach,	2.42 pounds.
Stomach fat,	13.50 pounds.
Intestinal fat,	7.50 pounds.
Feet,	20.62 pounds.
Tongue,	3.37 pounds.
Head,	31.00 pounds.
Hide,	75.50 pounds.
Odd pieces,	9.18 pounds.
Loss,	39.49 pounds.

Deducting the average of 116 pounds for each of the four quarters, we have left the following items and weights which may be included in the "fifth or butchers' quarter:"

Heart,	3.94 pounds.
Liver,	7.75 pounds.
Stomach fat,	13.50 pounds.
Intestinal fat,	7.50 pounds.
Tongue,	3.37 pounds.
Hide,	75.50 pounds.

From these figures the beef may be divided thus:

Fore quarters, each 111 pounds; hind quarters, each 121 pounds; "fifth or butchers' quarter," 111.56 pounds.

"According to the figures given by Secretary Edge, the census of 1890 shows but 211,577 farms in the State, while that of 1880 gave us 213,542. What has become of the 1,965 missing farms?"

The general inference would be, arguing from the premises furnished us by the census of previous decades, that there should have been more farms in 1890 than in 1880, but the official returns of the Census Bureau gives the figures as stated in the question.

A careful examination of the figures given by the Census Bureau shows that while thirty-one of the counties of our State have increased the numbers of their farms, the other thirty-six show a falling off in the number, which, in the State at large, not only overcomes the increase in the other thirty-one, but leaves a balance of 1,965 as missing.

The figures show that the following counties have increased the number of their farms to the extent of the figures affixed to each:

Armstrong,	101	McKean,	253
Beaver,	19	Mercer,	186
Berks,	105	Mifflin,	12
Cameron,	95	Philadelphia,	21
Carbon,	93	Pike,	91
Chester,	3	Potter,	28
Clearfield,	82	Somerset,	78
Clinton,	54	Sullivan,	32
Crawford,	342	Tioga,	86
Elk,	41	Venango,	246
Fayette,	89	Warren,	185
Forest,	192	Washington,	33
Fulton,	11	Wayne,	73
Greene,	24	Wyoming,	85
Indiana,	206	York,	403
Lancaster,	370		

The following counties have decreased the number of their farms to the amount indicated by the figures attached to each:

Adams,	278	Juniata,	163
Allegheny,	187	Lackawanna,	128
Bedford,	20	Lawrence,	61
Blair,	46	Lebanon,	75
Bradford,	243	Lehigh,	168
Bucks,	129	Luzerne,	107
Butler,	20	Lycoming,	100
Cambria,	196	Monroe,	7
Centre,	220	Montgomery,	753
Clarion,	32	Montour,	44
Columbia,	214	Northampton,	608
Cumberland,	39	Northumberland,	173
Dauphin,	25	Perry,	155
Delaware,	214	Schuylkill,	125
Erie,	41	Snyder,	233
Franklin,	307	Susquehanna,	98
Huntingdon,	188	Union,	81
Jefferson,	45	Westmoreland,	50

The subdivision of farms in the more thickly and older counties should have caused an increase in their number of farms, but, in spite of this, we find that such counties as Montgomery and Northampton have fallen off to the extent of over 600 farms each. The only way in which this change in figures can be accounted for, is to admit that there have been errors, either in the census of 1880 or

that of 1890; no other supposition will account for the great difference.

In some of the mountain counties, the high prices of farm products which prevailed during and after the war, no doubt stimulated the clearing up of farms which have since been abandoned, but in such counties this falling off is not supported by the census figures.

"Are the returns made by our assessors sufficiently reliable for the purposes of statistical information?"

Careful examination will show that such returns are valueless for the purposes of collecting statistical information. This arises not only from a difference in the mode of procedure in different counties, but also from a difference in the estimates of assessors in each township. It will be found that in some townships the assessment much more nearly approaches real value than in others, and that while some counties profess to assess at real values, others base their assessment lists upon half, and in some cases one-third value. One of our counties directs its assessors to value real estate at its real value, and return one-half of this for taxation; this, in effect, ends in the assessors returning about two-thirds value, one-half of which is accepted as the basis of taxation. If this was the universal rule of the township or county, no special injury would be done to the interests of any, for the lower the rate of valuation, the higher the millage rate would be; no matter what rate of assessment is adopted, if it is universal in its application, it will not affect the amount to be raised by taxation; and it naturally follows that a low valuation must be followed by a high mill rate.

In our investigations into the question of taxation, we have found that in one of our counties, in which the basis of assessment is ostensibly one-half, the real estate of resident owners is assessed at about one-half value, while that of non-residents is assessed, in some cases at least, at more than its full value.

In fact, it appears that, in many cases, the trouble now experienced in taxation is largely due to irregular and uneven assessments, and that if these were equalized, the average ratio of taxation would be much more nearly just and even; in fact, this irregularity in assessments is, in very many cases, responsible for much of the dissatisfaction which now exists.

In very many cases the taxpayers fail to distinguish between a low valuation and a low tax rate, and they also fail to see that a high assessment must produce a low millage rate. We can see no good reason why real estate should not be assessed at its real value; this

plan would not increase the tax; it would merely equalize and render fair many of the inequalities and disadvantages of the present irregular system.

The irregularity of assessments of real estate are, however, much less than those which follow the assessment of personal property and farm stock. In some of our counties a cow of any and all kinds, is valued at $40.00, while in other counties, the same cow, without regard to actual value or productive capacity, is valued at $20.00 to $25.00. In the same way, horses are given a universal value throughout the county, no matter whether they are stallions worth $2,000.00, or common farm horses, worth but $50.00, or even less.

Again, we claim that no good and justifiable reason can be given why real estate and personal property should not be assessed and taxed upon its real and actual value. Such a plan would, without affecting the total tax raised, decrease the mill rate, and equalize all of the burdens of which we now hear so much complaint.

"It has been stated that some Chester county farmers are making money rapidly by erecting green-houses and producing carnations, tomatoes and grapes out of the regular season. Could not other sections succeed equally as well in the venture?"

No doubt they could, if they would take an equal amount of care and pains with the products. It is not so much the location or crop as it is the man, in bringing success in these lines. Where one succeeds, four or five will, no doubt, fail, and it would appear that in these, as in all other special productions, much depends upon the man. High priced butter is, in the hands of certain persons, a very profitable production, but the market is not yet supplied with all it will take. Fruit out of season, commands high prices, and the demand is not yet fully supplied.

If all, or even double the present number, were to engage in the winter culture of carnations, no doubt the supply would exceed the demand; the demand for winter tomatoes, at high prices, is limited, and if the present number of growers was doubled, the prices would rapidly fall.

Another view of the question is that the profits of special productions and special crops are often the results of the balance sheet of the most successful producer; and the figures given are far above those of the average producer. If the production of carnations offered, or the average, any unusual profits, others would not be slow in finding it out, and in supplying the demand, until the profits were reduced to that of other crops.

"What is the best feed for farm horses?"

Most farmers answering this question in an off-hand manner will no doubt say, "oats;" but is not this endorsement of oats more a question of convenience than knowledge? Is it not possible that, notwithstanding the general use of oats, that mixed food composed of grain and hay or other products, may be more economical and better than oats?

The New Jersey Experiment Station (report of 1893, page 179), gives the result of an experiment in feeding horses engaged in farm work, which, from its practical nature and the care which was exercised in even its minutest details, furnishes interesting food for thought, even to those who endorse oats as an exclusive food.

The trial lasted for six months, or from June 1 to December 1; both lots were fed six pounds of ground corn and eight pounds of good timothy hay; in addition to this feed, lot 1 received six pounds of dried brewers' grains, and lot 2, five pounds of wheat, bran and one and a half pounds of linseed meal.

The report states that "the weight of the animals remained remarkably uniform. The difference between the highest and lowest did not exceed seventy-five pounds in any case, the lowest recorded occurring in July, except for horses, lot 3, whose final weight was the lowest. The average weight for the six months is practically identical in all cases with the average weight of the first month, though it is lower in all cases than the first weight recorded, and is uniform for both lots. The uniformity in the amount of food consumed and in the weight of the animals, in connection with the work performed, indicates no material difference in the usefulness of the two rations used; both were entirely satisfactory."

It is observed that the cost of the dairy rations used is much less than is ordinarily charged for feeding work horses. That is, for the six hardest months in the year a farm horse of 1,000 pounds, live weight, may be fed for $30.84 when dried brewers' grains furnish the bulk of the necessary protein, and for $33.49 when wheat, bran and linseed meal are the chief sources of this nutrient; on the basis of actual cost of the rations only, the brewers' grain ration is slightly more satisfactory than the wheat bran ration. When the fertility value of the dried grains, wheat, bran and the linseed meal is regarded of importance, the differences in the rations are less marked.

"Which is the most economical manner of cooking meat, roasting or boiling?"

In alluding to the theory of cooking, Prof. Halliburton thus reviews the matter:

"It destroys all parasites and danger of infection. This relates not only to bacterial growths, but also to larger parasites, such as tape worms and trichina.

"In the case of vegetables, it breaks up the starch grains, bursting the cellulose and allowing the digestive juices to come in contact with the granulose.

"In the case of animal foods, it converts the insoluble collagen of the universally distributed tissues into the soluble gelatin. By thus loosening the mending material, the more important elements of the food, such as muscular fibers, are rendered accessible to the gastric and other juices. Meat, before it is cooked, is generally kept a certain length of time to allow 'rigor mortis' to pass off.

"Of the two chief methods of cooking, roasting and boiling, the former is the more economical, as by its means the meat is first surrounded with a cool, coagulated proteid on its exterior, which keeps in the juices to a great extent, letting little else escape but the dripping (fat); whereas, boiling, unless both boullion and bouilli are used, there is considerable waste. Cooking, especially boiling, renders the proteids more insoluble than they are in the raw state; but this is counterbalanced by the other advantages that cooking possesses."

Dr. Atkinson writes:

"We may define the art of cooking as consisting in applying heat to each of these subjects in such a way as to render it digestible, so that its nutrient properties may be assimilated in true proportion in the human system; to render it appetizing by the development of its own specific flavor; to combine different kinds of food material in such a way that each will render the other palatable; to remove certain portions which may not be palatable or digestible after the first application of heat, either as waste, like bone; as excess, like much of the fat, that may be used for other purposes; or, as woody fiber, in many vegetables; to add to the essential elements salt in its due proportion in almost every process, and sugar in some combinations, and other condiments, spices, or flavorings, in such a way as to develop, rather than disguise, the true flavor of the principal food material entering into each dish."

"What are the duties of the Game Commissioners, and how are they appointed?"

The Game Commissioners are appointed by the Governor under authority conferred by the act of June 25, 1895; they are six in number, no two of whom shall come from the same Senatorial district;

they are to serve without compensation, and no appropriation is to be made for their expenses; they have authority to appoint ten men to be known as "game protectors" whose compensation is to come from the fines collected, one-half of which is to be paid to the game protector of the district in which the prosecution is brought. The game protectors give bond in the sum of one thousand and five hundred dollars, respectively, the former for the chief, and the latter for the other nine.

The act thus defines the duties of the Commissioners:

"It shall be the duty of said board to protect and preserve the game, song and insectivorous birds and mammals of the State, and to enforce, by proper proceedings, the laws of this Commonwealth relating to the same. It shall be the duty of the board to collect, classify and preserve all such statistics, data and information as in their judgment will tend to promote the objects of this act; to take charge of and keep all reports, books, papers and documents which shall, in the discharge of their duties hereunder, come into their possession or under their control."

"What remedy has a farmer against fishermen, gunners and others who trespass upon private property?"

He has the right of suit at law for damages, but can only recover the amount of damage done, which, in such cases, is usually merely nominal. The act of June 18, 1895, provides: "That any person or persons who shall wilfully enter or break down, through or over any field, orchard, garden or yard fence, hot-bed or greenhouse, or who shall wrongfully club, stone, cut, bark, or otherwise mutilate or damage any field crop, nut, fruit or ornamental tree, shrub, bush, plant or vine, trellis, arbor, hot-bed, or greenhouse, or who shall trample or in any wise injure any grain, grass, vine, vegetable or growing crop, or who shall wilfully take or carry away any grain, corn, rye, wheat, or other field crop, fruit or vegetable, plants, nuts, or berries or any fruit or ornamental trees, vine or shrubs, whether the same be attached to the soil or not, shall be subject to a penalty not exceeding fifty dollars for each and every offense."

"In his talk this afternoon, Secretary Edge spoke of adulterated lard; what is it adulterated with?"

Probably the most common adulterant is water, of which fifteen to eighteen per cent. may be worked into the lard, especially if a small portion of potato or other cheap starch flour is first added.

During cold weather cotton-seed and other cheap oils are added, and in some cases beef-fat is used, although the latter is added to improve, rather than adulterate.

"Do we as farmers invest too much money in machinery and might not the work be done more cheaply by hand?"

The question is hardly a fair one, as it is mostly out of the question to obtain the necessary hand labor just when it is wanted most. If hand labor could be obtained at reasonable rates just when wanted, and in the amount wanted, the latter might possibly prove the most economical.

It is safe to estimate that, with the care given by the average farmer, it costs one-fifth to one-fourth of the cost of the machinery each year that it is used. That is, if the implement cost fifty dollars, it will cost from ten to twelve dollars for wear and tear and repairs, to use it under the care and oversight of the average farm hand.

"What is the cheapest power for use on the farm?"

For the average and ordinary purpose for which power is wanted about the barn there is probably no cheaper form than that of a light tread power which can be readily moved from place to place. If equipped with a good governor, as they always should be, it can be used for any purpose for which light power is wanted on the farm. The governor will prevent any excess of speed when the whole power of the animal is not necessary for the work in hand, and should any irregularity exist in the work, this irregularity will not affect the running to any extent, the surplus being taken up almost immediately by the governor.

For shelling corn, cutting hay or fodder, or for sawing wood, such a power will perform all that is required of it, and with the governor it is as safe as ordinary farm work can be.

"Why not use glazed sewer pipe for road culverts?"

Because, as a rule, such culverts are not laid deep enough to keep the glazed pipe from being injured by wheels and heavy loads. The ends of the pipe, which must necessarily be uncovered, also suffer by frost, as well as breakage from other causes. In Southeastern

Pennsylvania the best material for road culverts appears to be condemned water and gas pipe, two sections of which make a lasting culvert which will not need renewal for an ordinary life time. Where these can be obtained at a reasonable cost, they are the most economical material which can be obtained; the first cost is probably not much greater than that of good two inch oak plank, and they will last much longer.

"Are hay loaders profitable?"

They do not give satisfaction upon uneven or hilly ground nor in windy weather, and their failure in both cases is due to the fact that, being constructed for perfectly level ground, they will not put the hay in its proper position on the load but will always drop it nearest the lower side or to the side opposite to that from which the wind is blowing, and if the team is a good one and the windrows fairly large, it is absolutely necessary that the delivery be made at or near the middle of the wagon, or the loader will not be able to distribute it so that it will remain on the load.

On fairly level ground they perform the work very well and save much labor but like all other high priced harvesting implements are only profitable on account of the scarcity and high price of labor.

If labor could be obtained as readily and as low prices as fifty years ago it is quite probable that, counting interest and wear and tear as well as repairs, hand labor would be quite as economical as machinery.

"Would you recommend the use of glazed tile for draining?"

I would not; it costs more than ordinary tile, and has no advantage over it, but has some disadvantages. The only case in which it can be used to advantage is in such cases, which, however, are very rare, in which the drain descends rapidly, and in which the ordinary drain tile may allow too much of the water to escape through the soil.

"What is the cheapest material for underdraining?"

An answer to the question must more or less depend upon location, the convenience of stone, the cost of tile, the difficulty of digging the ditches and other circumstances which are not and cannot be stated in the question. If good flat stone are close at hand and

the digging easy, it may pay to use them, but our own experience would lead us to use nothing but good drain tile, and to refuse to use stone delivered at the side of the drain. If stone are used, they require considerable time to lay them properly, and if not laid carefully, the drain will soon become stopped up. When stone are used it is necessary to remove four or five times as much earth as for tile, as the stone drain must be at least one foot to fourteen inches wide in the bottom, when four inches wide at the bottom is ample for tile.

"Does underdraining pay, and if so why?"

It is doubtful, whether it will pay with the present low prices of land to underdrain large areas, but there are on almost every farm, corners and places in the fields which are in the way, and which render plowing and cultivation difficult. These may be drained with profit, and will pay for the work by the increased crop of the first four or five years. The writer has laid underdrains which paid for the whole cost of the work during the first three years, and are still working satisfactorily, paying over ten per cent. upon the investment. The cost will vary so much with the digging, character of the soil, cost of tile or other material, and with location, that no intelligent estimate can be given; the extremes are probably not far from $25 and $45 per acre.

"Mrs. Rorer, in effect, states that of all the trades the farmers' family uses the worst balanced ration upon their tables; is this correct?"

Possibly when considered theoretically, it is; but then rations for individuals, like those for cattle, may be all right theoretically and all wrong practically. Mrs. Rorer, or any other good authority, might fix up a ration for me which would be all right theoretically, but after all I might prefer to be a little less scientific and eat what I wanted, even at the risk of not having a properly balanced ration.

We, like our live stock, have digestive organs very differently constituted; one can digest pork and cabbage and grow fat upon it, and, science to the contrary notwithstanding, work well and live long upon it; my neighbor possibly has a differently constituted stomach and cannot digest this kind of food; it is to him, no matter what science may say, an unbalanced ration, and he will neither grow fat nor work well upon it. It is, however, true that there is more danger from poorly balanced rations of food than from those properly balanced, but this danger and possible injury is dependent more upon the

individual than upon the food, and no rule can be laid down for the government of either.

There is not the least doubt, however, that the rations used upon the table of the average farmer might be improved upon, and if the good wife had the choice that falls to the lot of her city sister, would at once be improved upon, but during the winter months the farmer's wife, especially if away from the city and line of travel, has but little choice of the food which goes upon her table. The pork and flour barrel must necessarily, whether right or scientific, furnish the bulk of the farmer's food, and until this is remedied, there will not be much gain in the line of improved rations for farmers.

"What are the provisions of the inter-state commerce law to which one of the speakers alluded this morning?"

Inter-state commerce law controls and governs the passage of articles of commerce between states or through states; it prevents, within certain limits at least, the interference on the part of any one state with articles en route to another state. Thus, for instance, the inter-state commerce law would protect cheese en route from New York into Pennsylvania until it reached its first sale in our State; at this point, the State laws take effect, and the cheese becomes liable to the police regulations of our State. Until it is offered for sale in our State, the State officers cannot enforce the laws of the State, and the article is under the protection of the National government.

Diseases of live stock furnish us with another instance of the provisions of the inter-state commerce law. Animals in transit from one state to another, if diseased, are under the control of the National Government, and State officers can not interfere with them; when they are unloaded and offered for sale, they lose their identity as articles of commerce en route to another state, and become amenable to the laws of the state in which they are sold or offered for sale.

In the enforcement of the act to regulate the manufacture and sale of cheese, the provisions of this law are shown by the fact that the Department of Agriculture cannot enforce the provisions of the cheese law until the goods reach an ownership in the State; they may be brought into the State and remain in storage indefinitely without being subject to our State laws, but as soon as they become a portion of the general property of the State, they become amenable to the law alluded to.

"What is the best method of destroying mould or mildew in cellars and preventing its formation.

There is probably no application as cheap or as effectual as whitewash, freshly made; if applied hot, its effects will be all the more

marked. Care should be taken to get it into every crevice, and a single spot missed will serve as a hot bed for generating fungi, which will eventually do injury to all products kept in the cellar.

Some strongly recommend the addition of a small amount of copperas to the whitewash; others recommend the use of coarse salt. If the application is carefully and frequently made, no addition to the lime will be necessary.

If, after the liberal application of whitewash, the difficulty still exists, there is probably nothing more efficient and economical as sulphuric acid, formed by burning sulphur in the cellar. All openings and crevices should be carefully closed and the sulphur burned either in a heated iron pot, or in a similar vessel, on hot coals. This acid destroys all forms of fungoid life which may be present, either on the walls of the cellar or in the atmosphere, and thus removes all tendency to mildew or moulds.

"What is the cost of a good Osage orange hedge?"

So much depends upon the manner of planting and treatment that it is difficult to give a satisfactory answer to the question. A number of years ago the Secretary of the State Board of Agriculture issued a number of circulars to farmers who were known to have planted more or less hedge, and their answers were so varied that it was very difficult to tabulate anything like a satisfactory result. The estimate for the number of plants per one hundred rods varied from 2,500 to 4,000, and thick and thin planting each had their respective advocates.

Our own experience would indicate five inches as the proper distance apart for the plants, thus making the number for each hundred rods about 3,500.

Taking the answers which furnished the described data, and discarding all that were evidently defective, the average result was about as follows:

3,500 plants at 50 cents per hundred, ...	$17 50
Preparing ground for the hedge, ...	8 50
Setting plants already trimmed at the nursery,	4 75
Trimming and cleaning during first year, ...	2 50
Trimming and cleaning during second year, ...	4 00
Trimming and cleaning during third year, ...	4 50
Trimming and cleaning during fourth year, ...	5 00
Total cost of hedge at 4 years old, ...	$46 75

Many plans of planting were advocated, and their estimated cost varied, for one hundred rods of hedge, from three to five dollars. A few even exceeded the latter figure, but were all for planting on sod, which materially increased the expense. The writer, in all of his planting, always so arranged it that the line of the intended hedge should be one of the rows of a corn field and, hence, at planting time, there was no sod, and the ground was in excellent condition for the growth of the young hedge plants. After a careful double plowing, a furrow was drawn along the line of the proposed hedge so that the straight land side was exactly where the plants were wanted; they were carefully placed against the land side of the furrow, their lower ends resting on the bottom of a rather deep furrow, and the finer portions of the soil drawn in with hoes and tightly tramped down around the plants, of which not more than one per cent. were lost and needed resetting the next autumn.

"Are potato diggers a success?"

So much depends upon circumstances that the question may be answered either in the affirmative or negative; they do pay if every thing is in proper condition for their use; if the soil is just dry enough and not too dry, if it is free from stones, if the potatoes are not too deep—in fact if all the surroundings are favorable. Mr. Terry, well known to those who attend Pennsylvania farmers' institutes, a few years ago wrote as follows:

"It seems to me that, with over 500 diggers patented, we have not yet, so far as I know, a perfect one; I have tried one of the best, the price of which was $125. The manufacturer was here in person, and every possible effort was made to make it work, but it has gone back. I know it does work satisfactorily under some conditions, for parties using it have written me so. On level prairie or other light soil, with potatoes hilled, I should think it would do fair work. With us, it left too many tubers covered up. We dug the ground over with a fork and found some eight or ten bushels per acre. This, at the lowest price we ever sold the crop for, would pay for hand digging. But we shall soon have a perfect digger; it will only be a matter of time; meanwhile, if we keep our fields clean, it will not cost much to dig by hand. It cost me just one cent a bushel to dig my crop by hand in some years. This may be hard for some to believe, but it is a fact. One man dug all but a few. He had worked for me some five years, and was an expert in that line. One week he dug 180 to 190 bushels per day for six days. His best day's work, in nine hours (he had to stop before night to cover the piles), taking the potatoes right through the field, just as they came, was 223 bushels."

"What is the best winter ration for breeding ewes?"

There is probably no feed much better for breeding ewes, before lambing time, than good, clean, clover hay, with an occasional feed of good corn-fodder. After lambing, small potatoes, or roots of any kind add greatly to the value of the ration. Care should be taken not to feed roots too soon after lambing, and never before, as they may, in connection with clover hay, induce too great a flow of milk and cause trouble in this direction.

Timothy hay should not be fed, and corn and oats, whether whole or ground together, is preferable to corn alone; corn is too fattening and does not contain enough protein; oats, wheat bran, barley and cottonseed or linseed meal, fed in small amounts will balance the ration up, but all should be fed carefully and sparingly until after lambing time.

"Who owns the land covered by a public road?"

Unless there is some specific action to the contrary, it belongs to the adjoining land owner, and, as a rule, the farm lines extend to the middle of the public road. When the road was laid out, the original owner of the land granted the public the right of way over it and nothing more; the public has no right to the earth alongside the road, or to minerals found alongside or in the road; they all belong to the party or farm from which the land was taken.

All fruit, grass, etc., along the public highway belongs to the adjoining land owner, and the public has not the right to it any more than they would have to similar crops within the farm fences.

Numerous cases may be cited to prove this point:

In the case of Cole vs. Drew (44 Vt., 49), Drew's children in going over the road to school had their clothing wet and injured by long grass growing along the road through the farm owned by Cole; Drew obtained permission from the road supervisors to cut the grass, and after cutting it, hauled it home and used it to feed his stock; Cole brought suit for the value of the grass thus cut, and obtained judgment; the Supreme Court affirmed the judgment.

In the case of A. Kirk Lewis vs. Thomas Jones (1 Penna., 336), the Supreme Court of this State ruled as follows: "No principle is more familiar or better settled than that the right of the soil in the highway resides in the proprietor of the land over which it has been laid, and that the citizen has no more than a license to pass along it with carriage and cattle, an abuse of which, like the abuse of any other license given, not by the party, but by the law, makes him a trespasser against the proprietor from the beginning."

Hon. F. H. Bennett, of Taunton, Mass., in referring to the rights of the road, gives the following:

"No other man has the right to feed his cattle there, to cut grass or trees, and much less deposit his wood, old carts, wagons or other things; after notice to the owner, you may remove them to some suitable place, and if they are lost or injured, it is not your fault. The owner of a drove of cattle which stop to feed in front of your land, or of a drove of pigs which root up the soil, is responsible to you at law as much as if they did the same things inside the fence. Nobody's children have the right to pick up apples under your trees, although they stand wholly outside the fence. No private person has the right to cut or lop off the limbs of your trees in order to move his old barn or other buildings along the highway, and even if the owner has a license to move the same through the streets, this does not exempt him from liability to private sufferers. No man has the right to stand in front of your land and whittle or deface your fence, throw stones at your dog, insult you with abusive language without being liable to you for trespassing on your land."

Perhaps it may be well to state here, that if the highways become suddenly impassable by heavy snows or deep gullies, he may turn aside into your adjoining land without being liable as a trespasser, if he does no unnecessary injury.

"In passing on a public road, whose duty is it to turn out?"

In referring to this question, Hon. G. W. Hood, of the Indiana bar, in an essay read while he was a member of the Board, used the following language in relation to the duty to turn out when teams are moving in the same direction:

"As to the law of the road a traveler may use the middle or either side of the highway at his pleasure, and is not obliged to turn out for another traveler in the same direction, provided there is convenient room for him to pass on the one side or the other. The road is intended for the accommodation and convenience of all travelers, and he who starts on a journey in a pleasure carriage has no more rights to the road than a teamster moving slowly along with his heavy load.

"It is the general custom of the country, though I do not know that it is the law, that a loaded wagon has the preference, and the light wagon should be required to turn out if necessary, if both vehicles were moving in the same direction. The loaded wagon, however, must not become an obstruction on the road or cause delay to the traveling public, or the teamster must not be guilty of wilful or wanton delay."

In the case of Grier vs. Sampson (127 Penn., 183), the Supreme Court decided practically, that while it was in general the rule that teams should pass to the right, yet in the case of a light wagon meeting a heavily loaded one, it was the duty of the former to give way.

There is nothing, whatever, in support of the prevailing idea that a mail coach or wagon has the right of way over all other travelers; this was affirmed in the case of Bolton vs. Calder & Wilson, (Wallis, 360).

The road laws of Massachusetts provide that "When persons meet each other on a bridge or road, traveling with carriages, wagons, carts, sleighs, or other vehicles, each person shall reasonably drive his carriage or other vehicle to the right of the middle of the traveled part of such bridge or road, so that their respective carriages or other vehicles may pass each other.

"The driver of a carriage or other vehicle passing a carriage, or other vehicle traveling in the same direction, shall drive to the left of the middle of the traveled part of a bridge or road; and if the bridge or road be of sufficient width for the two vehicles to pass, the driver of the leading one shall not wilfully obstruct the same."

"From what law is the right to work out the road tax derived?"

The act of April 15, 1834, provides, "That before issuing the duplicate and warrant for the collection of road taxes, it shall be the duty of the supervisors of every township to give notice to all persons rated for such taxes, by advertisement or otherwise, to attend at such times and places as such supervisors may direct, so as to give such persons full opportunity to work out their respective taxes."

The courts have several times ruled that before a road tax can be collected in cash, the taxpayer must first have had an opportunity to work out his tax; if this opportunity is neglected or he refuses to take advantage of it the proper officer can then proceed to collect in cash.

In the case of Miller vs. Gorman, the payment of $216 in road taxes was involved; the owners of the property were non-residents and, without having given them notice, as required by law, the supervisors proceeded to collect the tax in cash; payment was resisted and the court ruled that the notice should have been given to the agents or tenants on the property and represented the owners; in the opinion the court stated that "the vigilance of the tenants took away all of the importance from the non-residence on the part of the plaintiffs."

Except where a more recent law provides that one-fourth of the tax may be collected in cash for the purchase of improved imple-

ments, the old law of 1834 holds, its working out clause having been continued in the act of 1836, which is practically our general road law now.

"Have traction engines any right on the public highways?"

The act of June 30, 1885, is "To regulate the movement of machinery propelled by steam upon the public roads and highways of this Commonwealth," and the State having thus regulated their movement, of course recognizes their right on the public highways. The law makes it the duty of those in charge of such engines passing along the public roads to "assist such passengers and teams until they are safely by the danger and if there be any obstruction to the view of the road, it shall be the duty of the owner or owners or persons in charge of such machinery, not to approach such obstruction nearer than three hundred feet without going to the place to see that the road is clear, or sending some competent person for the purpose."

When obeying the provisions of this law a traction engine has the same right upon the road as any other vehicle and these rights must be respected by road supervisors.

This right upon the road implies that the supervisors must at all times have the roads in a condition to make them safe and passable for such engines, and if any bridge should break down under such an engine, the township is liable for damages in the same manner as if the bridge had broken under an ordinary team hauling a load of ordinary weight; hence all bridges must be strong enough to support a traction engine or the township will suffer. On account of the special damage done to bridge plank by the peculiar wheels of traction engines, two attempts have been made to secure legislation requiring that they shall carry oak plank which shall be laid down over the bridge plank before the engine crosses the bridge, but in both cases this legislation failed to become a law.

"Cannot the condition of our roads be improved by changes in our road laws?"

This admits of two answers—yes and no. If the writer is to judge of our people by the debates in the Legislature, and sometimes in farmers' institutes, he would be perfectly safe in coming to a conclusion that good roads may be made by legislation, but in practice we find that this is by no means the case. Until our people are educated up to it, the chances are that changes in our road laws will produce but

little practical effect. So long as we are careless in the selection of our road supervisors, and, after electing them, allow them to do exactly as they please, we need not look for much improvement under any law that can be enacted.

The great difficulty with road legislation in our State is that no general law can be drafted to suit all sections; the law which would give good results in Chester and Montgomery counties would be of but little practical value in Carbon and Cameron. It would therefore, seem as if we would have to get along with a kind of skeleton act which would be expansive enough to suit all sections and yet preserve the outward form of a State law.

But the misfortune is that legislation will not make good roads; if it would, then we should, with our four hundred or more local laws, have about the best roads in the nation. Money and men are both necessary for good road building, and unless we have both and get them together, we will not obtain good results. In many cases we undoubtedly have both, and they fail because we do not get them together. Some townships vote considerable sums of money and have poor roads, while others collect a lower road tax and have better roads; the first may have the money and the second the men; if both were joined, better results would have been attained.

The new law has not yet gone into effect, and we are, therefore, working under the same law as one year ago. Examination will clearly prove that either law is capable of giving us good roads, but that neither will do it without good management and funds; under the present law, the supervisors can macadamize the roads of their townships, but to do this they must be backed up by funds and the co-operation of the people who are interested and who pay the taxes. With this co-operation, the average supervisor can, under the present law, give his constituents good roads, but they must expect to pay for them.

"If the fences along the road are removed, who is responsible for damage done by stock passing along the road?"

In his address upon the fence laws of Pennsylvania, at the annual meeting of the Board of Agriculture, in 1893, Deputy Attorney General Stranahan laid down as a principle at law that by the repeal of the general fence laws of 1700 and 1784, the party driving the stock along the public road would be responsible for any damage that they might do. The principle has been thoroughly established that in a public road nothing but the right of way is given up by the original owner, and that those who use our public roads have

only the right to pass over and use the legal width of the road, and any use of a wider strip is a trespass which renders the trespasser liable for any damage done.

The language used by Mr. Stranahan is as follows:

"The act of 1889 repealed the first section of the act of 1700, and, therefore, I think by my examination of the law, that to-day in the State of Pennsnylvania, there is no fence law; that is, I mean a general fence law as to enclosures of a man's land, and, consequently, we come back to the common law rule that existed prior to the act of 1700; and, therefore, the farmer instead of fencing out his neighbors' cattle, has to fence in his own to prevent them from doing damage to his neighbor, and I think the law is to fence in his own cattle, rather than to fence out the cattle of his neighbor. I think the original acts of 1700 and 1784 have been repealed in the State of Pennsylvania, and it is so held by at least three judges of the court of common pleas in the State of Pennsylvania—Judge White, Judge Mayer and Judge Brown, of Warren county. I do not know that it has gone to the Supreme Court. These judges have held that we have no fence law as to the enclosure of a man's land, and that every man has to fence in his own cattle; and if he does not, and they get out and do damage to his neighbor, he must respond in damages."

In replying to another question, Mr. Stranahan stated that it did not matter how the animals got upon the public road; that the effect as to recovery of damages would hold as good if they were driven along the road as if they had broken out of their owner's fields.

"What are the provisions of the act relating to division fences on the farm?"

Division fences, outside of Philadelphia, where they are governed by a special law, are regulated by the act of March 11, 1842, the provisions of which are as follows:

Section 1 makes the auditors of the township the fence viewers of their township.

Section 2 provides for filling any vacancies in the office of auditor, whether by death, resignation or other cause.

Section 3 is as follows: "When any two persons shall improve lands adjoining each other, or where any person shall enclose any land already fenced in so that any part of the first person's fence becomes a partition fence between them, in both of these cases, the charge of the division fence, so far as is enclosed on both sides, shall be equally borne by both parties."

Section 4 regulates the manner in which fence viewers shall perform their duties, and also regulates the manner in which they shall be notified by parties dissatisfied with a division fence.

Section 5 provides that "If the party who shall be delinquent in making or repairing any fence shall not within ten days after a copy of the certificate of the viewers shall have been delivered to him, proceed to repair or build the said fence, and complete the same in a reasonable time, it shall be lawful for the parties aggrieved to repair or build the said fence, and he may bring suit before any justice of the peace or alderman against the delinquent party and recover as in other actions for work, labor, service done and material found, and either party may appeal from the decision of the justice or alderman, as in other cases."

One of the most recent cases which has come up under this law is that of Roberts vs. Sarchet, in the Chester county court.

The defendant having refused to put the division fence in proper repair, the plaintiff called in two of the auditors or fence viewers, who, after proper consideration and legal procedure, decided that the plaintiff should repair the fence and place it in proper order; this he refused to do, and the plaintiff proceeded to repair the fence and presented a bill of $26.68 for the cost of repairing his share of the line fence. Suit was brought in the proper court to recover, and after a hearing, the court decreed that the bill was a legal and just one; that the procedure under the act of 1842 had been correct and legal, and ordered judgment recorded for the plaintiff.

The defense claimed that the act of 1889 had repealed the act of 1700, upon which the act of 1842 rested; the court, however, held that the repeal of the act of 1700 in no wise affected the act of 1842, all the provisions of which remained in full force.

It has been decided that where there is an agreement between interested parties, that each shall keep a certain portion of a division fence in repair, that the agreement will hold, but that where no such agreement existed, the fence must be kept in repair at the joint or equal expense of both of the interested parties.

At a meeting of the Board of Agriculture, it has been shown that the difficulty is to obtain any remedy where the offending party is not responsible, and has no property upon which a levy can be made.

Since the repeal of the act of 1700, several attempts have been made by the Legislature to define the law in relation to division fences, but all attempts in the direction have met with so much opposition that they have failed.

"What can be done to decrease the cost of fencing?"

In his report for 1877, the Secretary of the State Board of Agriculture wrote as follows:

"In 1877, I made the subject of fencing and its cost a specialty with our official reporters. The result arrived at was, that the av-

erage Pennsylvania farm of 100 acres required 955 rods of fence, costing $1.15 per rod, or a total cost of $1,124.25 per farm. The estimated cost of repairs was $6.32 per hundred rods. From this, it would seem that Pennsylvania farm fences cost $179,834,404.00, and the annual repairs $9,883,918.00 more.

"The returns of the National Department of Agriculture, give the cost of worm fences in this State at 95 cents per rod; post and rail at $1.35 per rod; boards nailed to the posts, $1.26 per rod, and stone fences $2.35 per rod.

"In view of not only the first cost of these fences, but also of the annual outlay needed to keep them in repair, it becomes an important question for the Pennsylvania farmer to decide whether it is not possible that a proportion of the expenses may be avoided. To gain this, there are several ways open—we may remove the division fences between certain fields so situated that they may be farmed in pairs—or we may very much decrease the amount of fencing by altering the shape of our fields. Theoretically, a circle will enclose the greatest amount of ground with the least possible fence, but, as this form is impracticable, we must fall back on the square as the next best. As we leave the square and increase the proportional difference between the breadth and length, we very rapidly increase the number of rails needed to enclose a ten acre field. In the thickly settled districts, all parties are slowly accepting the truism that a farmer fences to restrain his own stock, and not those of his neighbor. This, when fully appreciated, will work a partial remedy for the evil complained of."

"What are the duties of the 'fence viewers?'"

The act of 1842, relating to division fences, constitutes the auditors of a township a board of fence viewers, and makes it their duty, when called upon under the provisions of the act, to view and examine a line fence which may be in dispute as to its sufficiency as a barrier to stock; they are not to go upon duty to decide the location of the fence, but merely to pass upon its condition as a means of confining or turning live stock. The law is very explicit as to their duties, and also as to the manner and times at which they may be called out for duty; it also prescribes their mode of action with unusual exactness and plainness.

In cases in which the decision of the viewers does not receive the proper attention of the party whose fence is viewed and found insufficient, the law prescribes the following line of action:

"If the party shall not within ten days after a copy of the certificate of the viewers shall have been delivered to him, proceed to repair

or rebuild the said fence, and complete the same in a reasonable time, it shall be lawful for the parties aggrieved to repair or build the said fence, and he may bring suit before any justice of the peace or alderman against the delinquent party, and recover, as in other actions, for work, labor, service done and materials found; and either party may appeal from the decision of the justice or alderman, as in other cases."

Hon. A. N. Perrine, then member of the Board of Agriculture, in the report of that organization for the year 1881, thus lays down the rules of law governing division fences:

"1. Adjacent land owners must make an equal contribution to the expense of building and maintaining partition fences.

"2. Fences should be constructed according to the law applicable to each particular locality.

"3. When differences arise between owners of adjacent lands with regard to division fences, they may be settled by fence viewers.

"4. In the rural districts, the township auditors are required to perform the duties of fence viewers.

"5. A majority of the fence viewers of a township constitutes a quorum.

"6. A view by fence viewers, and a certificate in writing from them is necessary and sufficient before suit can be maintained for contribution.

"7. A fence viewer refusing or neglecting to act as required by law, is subject to a fine.

"8. Viewers are allowed five days notice, and they are entitled to one dollar per day for their services, to be paid as they may decide, from either party, or divided between them.

"9. Suit may be brought, if necessary, for the enforcement of the verdict of the fence viewers, but an appeal may be taken from the decision of the justice or alderman.

"10. Owners or tenants of adjacent, improved or enclosed lands only, can be required to build or contribute to the building and maintaining of partition fences.

"11. The only occupancy of a neighbor's land for the purpose of building or connecting to a partition fence not a trespass, is in the use of so much of said land as is necessary to place a worm or other lawful fence exactly and evenly on the line and connect thereto."

"What can be done to prevent the use of several names for one variety of fruit?"

That the evil exists is admitted by all, but the remedy is quite difficult of application. Many apples have at least five or six names by which they are known in as many districts of the State; some varie-

ties of potatoes are also given a numerous array of names, when in many cases, the only real variation is due to soil, manures or cultivation.

Joel A. Herr, one of the members of the State Board of Agriculture, has proposed the following combination of plans:

"1. Agricultural societies should offer premiums for no fruits (except new varieties), unless the correct name be given to the fruit on exhibition.

"2. A committee on nomenclature at each county fair should report the correct names of fruits on exhibition that are not correctly named.

"3. Premiums should be offered for the best map of an orchard giving the correct name and place of every tree.

"4. The State Agricultural Society and the Fruit Growers' Association should institute a committee and place where samples of any fruit in the State may be sent to ascertain the correct names, and to name new fruit varieties of value.

"5. Fruit dealers should insist that the proper names be given to the fruit they handle, thereby creating a market for the best varieties of fruit by their correct names.

"6. Nurserymen should not accept the local and improper names so frequently given to well known varieties of fruit.

"7. The National Fruit Growers' Society should endeavor to establish a common name for certain kinds of fruit, and discard all other synonyms.

"8. Very many of our common and inferior fruits should be discarded by nurserymen, and new varieties should be thoroughly tested before being generally disseminated, thus reducing the number of names."

"What is the cause of 'club root' in cabbage and turnips?"

Prof. Halsted, in his "Fungous Foes of the Farmer," gives the following in relation to "club-root:"

"The club-root of the turnip is caused by a slimy mould and receives its name from the fact that abnormal enlargements of the roots are produced and the plant's feeding capacity is so reduced thereby as to cause ruin. The fungus is without filaments and multiplies in the cells of the roots, causing them to grow out of the natural shape and soon decay with a very disagreeable odor.

"The fungus resides in the soil, and, therefore, any treatment that is given needs to be applied to the soil, instead of the plants. It had been found that upon land that is infested with the disease, slaked lime is quite effective, applied to the soil at the rate of seventy-five bushels per acre. This application may be made in the autumn before and left upon the surface until plowed under in the spring.

"Cabbage is equally susceptible with turnips to this club-root, and the failure of this crop may often be traced to this cause. The same soil treatment is advised as for turnips, and it goes without argument that when a piece of land fails with a crop of turnips by club-root, it should not be followed by cabbage, unless thoroughly limed."

"What notice is necessary to dispossess a tenant on the farm or the tenant in the house?"

This depends entirely upon the bargain; if there is a lease and it specifies that it is for but one year, then no notice is necessary, as the lease itself is a notice; if there is no written lease and no bargain with proper witnesses, then the notice must be given in accordance with law. In the report of the Board of Agriculture for 1883, Hon. George W. Hood, of Indiana county, thus answers this question:

"As to notices to quit, it has been held that where the tenant holds under a parole lease from year to year, a notice to quit must be given three months before the expiration of the current year; and if a lease be made from year to year, and the tenant be permitted to hold over from year to year, a notice to quit at the expiration of three months, given in the first month of a new year, is illegal, and the tenant has a right to hold for that year. If the landlord desires to repossess his premises, demised to his tenant for a term of years, he must give at least three months notice before the expiration of his term of his intention to do so, else he cannot in any way or by any means oust the tenant for another full year. If the current year begins to run from the first day of April of any year, he must give notice to the tenant not later than the last day of December prior to that time. No particular form of notice is required, neither need it be in writing, but the tenant must have such actual notice at least three months before the expiration of his term, as to fully warn him that the landlord desires the termination of the lease, and that he will be required to surrender to him the peaceable possession of his premises."

"What special rights has the original land owner within the lines or fences of a public road?"

The title to the land remains in the original owner, but he has surrendered to the traveling public the right of way over the land which has been dedicated to the public road; the public is entitled

to a free and unobstructed passage over the road and anything which in any manner interferes with this may be removed by the supervisors or road commissioners.

Mr. Hood, then member of the Board of Agriculture from Indiana county, thus refers to the question of ownership:

"The public acquires but an easement, and the proprietor of the soil, over which the road passes has as much right to protect himself against nuisances on the highways as if committed on his enclosed premises. If a drove of cattle or pigs be stopped before your door, or root up your soil, the owner is responsible to you at law as much as though they did the same thing inside your fences. No person has the right to stand in front of your door and whittle the fence, throw stones at your dog, or use abusive or profane language. All persons have a right to pass and repass in an orderly manner on the road and to use it for the purpose intended by law, but not to abuse it."

The same authority also states that:

"Notwithstanding the devotion of the surface of the soil to the public use, the title of the land remaining in the original owner of the soil, the owner of the fee retains his right to all mines, springs of water, earth, timber, and quarries which are within the road and not incompatible with the public right of way."

Mr. Hood also quotes the following, in support of his views, from decisions in Massachusetts and Iowa:

"That where a highway or street in a municipal corporation has been acquired by proscription, the fee remaining in the land owner, he has the right to all things connected therewith, such as trees upon, or mines and quarries under, the land over which the highway passes, subject only to the right of passage by the public, and the incidental right of repairing and keeping it in proper repair."

In a case before one of our courts it was shown that a citizen of a township cut the grass along a public road in order that his children might get to school without wetting their feet; the land on which the grass grew did not belong to him, but he hauled the cut grass home and fed it to some of his animals. The court decided that he had the right to cut the grass for the purpose named, but that in hauling it home and feeding it to his stock, he had violated the rights of the original owner of the land and was liable for damages.

"What are the provisions of the act allowing a rebate of road tax for the construction and maintenance of watering troughs along the highways?"

The act in question does not provide for an abatement of road tax for the maintainance of watering troughs; it authorizes the pay-

ment of a sum not exceeding five dollars per year for such troughs. In order to secure the payment of this amount the trough must be constructed in accordance with the following provisions of the act:

"That under the sanction and supervision of the supervisors of roads or road commissioners of the respective townships, or council or persons having charge of the streets of the respective boroughs of this Commonwealth, any person or persons or chartered societies not for profit, the object of which shall be to erect and maintain in good repair a public watering trough of not less than six feet in length, twelve inches in width, and ten inches in depth, in the clear, either of wood or stone, except that stone troughs shall not be less than two feet in length, and have pure clear water continually running into the same except in hard freezing weather, by pipe, pipes or otherwise, upon the side of the public highway, erected of sufficient heighth and easy of access for watering horses or cattle, and approved by the supervisors or road commissioners of such township or persons having charge of the streets in boroughs, shall be entitled to receive from the road fund thereof a sum of money not exceeding five dollars annually."

A proviso of the act is as follows: "That if more than one watering trough is erected and maintained within five miles on the same road, but one such trough shall be entitled to the benefit of this act, and the oldest and first trough shall have the preference."

Another proviso makes the following terms:

"That after the first payment and before receiving any subsequent annual payment, such chartered society shall publish a statement attested by the president and secretary certifying that all the money received from the road fund, as provided for by the said act, has been expended in the erection of troughs, and supplying the same with water or in keeping those already erected, in proper repair."

"What are the provisions of the act allowing an abatement of road taxes for trees planted along the public road?"

This right of abatement is obtained under the act of May 3, 1879, which is as follows:

"Section 1. Be it enacted, &c., That any person liable to road tax who shall transplant to the side of the public highway, on his own property, any fruit, shade trees or forest trees of suitable size, shall be allowed by the supervisor of roads, where roads run through or adjoin cultivated fields, in abatement of his road tax, one dollar for every four trees set out; but no row of elms shall be placed nearer than seventy feet, except locust, which may be set thirty feet apart, and

no allowance, as before mentioned, shall be made unless such trees shall have been set out the year previous to the demand for such abatement of tax, and are living and well protected from animals at the time of such demand.

"Section 2. Any trees transplanted to the side of the public highways as aforesaid, in the place of trees which have died, shall be allowed for in the same manner and on the same conditions as in the preceding section.

"Section 3. No person shall be allowed an abatement of his highway tax as aforesaid, more than one-quarter of his annual highway tax, and no one shall receive an abatement of tax for trees planted previous to this act.

"Section 4. Any person who shall cut down, kill, or injure any living tree planted as aforesaid, shall pay to the supervisors of roads as aforesaid, fifty cents for each and every tree cut down, killed or removed, to be collected as other road taxes are now collected."

"What is the 'bounty act' to which Secretary Edge alluded this morning?"

In 1885 (by the act of June 23, 1885), the Legislature offered a bounty upon foxes, minks, weasels, hawks, owls and other animals and birds supposed to be injurious to the interests of the farmer. Before the meeting of the Legislature, and in November, 1886, it was found that the law was causing such a heavy draft upon the county treasuries, from which all bounties are paid, that its repeal was demanded. In order to ascertain the exact status of the enforcement of the act, the Secretary of the State Board of Agriculture issued a circular letter to the commissioners of each county asking for the total amount of bounties paid under the law; by this it was found that from June 23, 1885, to November 1, 1886, the counties had paid not less than $72,000 per year.

The arguments in favor of a repeal of the law were as follows:

1. The act causes a drain upon the county treasury which is not warranted by the benefits received.

2. Hawks and owls, by the destruction of insects, confer a benefit, which is more than an offset to the loss occasioned by their destruction of poultry.

3. A number of county officers have been imposed upon and bounties paid which were illegally drawn.

4. It causes an increase in the work and duties of county officers without providing extra compensation for it.

5. It encourages a certain class to follow hunting as an occupation.

6. Self-interest would lead to the destruction of these animals and birds without the law.

The arguments against the repeal of the law were as follows:

1. This being the first year of its action the total amount of bounties paid will be greatly in excess of subsequent years, and, that, owing to the increasing scarcity each year, the amount will soon be very small.

2. By the repeal of the law the bounties already paid will be practically lost.

3. The destruction of the animals and birds protects the game.

4. All laws are subject to abuse and violation and this one is no exception.

5. The bounties upon foxes, minks and weasels forms but a small proportion of the total amount, a number of the county officers stating that fully fifty per cent. of the amount paid was upon hawks and owls.

6. Hawks and owls destroy so many small birds that their destruction will be a gain greater than the destruction of insects.

The law was repealed except as to a few kinds of the larger animals, and altogether as to birds.

"What is the law as to meeting teams on the public roads?"

It is doubtful whether we have in this State any direct law in relation to the duties of drivers when teams meet on the highways; but custom is in some cases stronger than law and attains to the same rights as direct law; custom directs that when teams meet, each shall turn to the right, but in the case of Grier vs. Sampson (27 Penn., 183), the State Supreme Court varied this, and decided that when a horseman or light team met a heavily loaded wagon or team and can pass safely on the left, it is the duty of the driver to do so; or in other words, it is his duty to give the loaded team a choice of sides in passing.

Hon. G. W. Hood, in an essay on "Law and Customs of Public Highways," read before the State Board of Agriculture, made the following statement:

"As to the law of the road, a traveller may use the middle or either side of the public road at his pleasure, and is not obliged to turn out for another traveler in the same direction if there is convenient room for him to pass on one side or the other. The road is intended for the accommodation and convenience of all travelers, and he who starts out on a journey in a pleasure carriage has no more rights to the road than the teamster moving along with his heavy load."

Chapter 93 (page 571), of the revised statutes of the state of Massachusetts, contains the following provisions:

Section 1. When persons meet each other on a bridge or road, traveling with carriages, wagons, carts, sleighs or other vehicles, each person shall seasonably drive his carriage or other vehicle to the right of the middle of the traveled part of such road or bridge, so that their respective carriages or other vehicles may pass each other.

Section 2. The driver of a carriage or other vehicle passing a carriage or other vehicle traveling in the same direction, shall drive to the left of the middle of the traveled part of the bridge or road, and if the bridge or road is of sufficient width for two vehicles to pass, the driver of the leading one shall not wilfully obstruct the same.

Section 3. No person shall travel on a bridge or road with a sleigh or sled drawn by one or more horses, unless there are at least three bells attached to some part of the harness.

The penalty for a violation is a fine not exceeding twenty dollars and liability for all damages done to the other team. Section 5th provides that "The provisions of this chapter shall not apply to street railways."

"If, as Secretary Edge stated yesterday, there is no proof of any material decrease in our rainfall when a long term of years is considered, why is it that our streams are lower than they were formerly?"

The streams are lower, not necessarily because there is any great diminution in the rainfall, but because so much of that rainfall is evaporated where the forests formerly stood and, consequently does not pass down the stream. It is also a well known fact that when the forests were in existence, the rain which fell in them was stored up by the leaves and roots, which acted as sponges, and held back and given up to the springs gradually, and thus prolonged, without increasing its actual amount, the water flow of the stream beyond. Now this water, instead of being stored up, runs off with a rush into the stream and is rapidly passed out of the district in which it fell, and which receives but little benefit from it.

Dr. J. T. Rothrock, State Forestry Commissioner, in referring to this question, uses the following language:

"It is certain that our woodland areas in which water is hoarded are decreasing and that in the same measure our areas of rapid evaporation, and from which the water flows with greater rapidity after the ground has been increased. This period of eighty years, from 1816 to 1895, during which the autumn flow of the Schuylkill has been gradually diminishing, is too long a reach to be explained

by any cyclic change of which we have any exact instrumental record —and certainly the cyclic explanation must be open to question. The decrease in water flow becomes more striking when it is noted that the deficiency of water occurs just at a time when we should expect the effects of summer evaporation over cleared areas to be most marked.

"Any excess of water which flows out of the country in a freshet leaves so much less in the country to maintain the even, average flow of springs and streams.

"Competent engineers inform us that as between two similarly situated and conditioned regions, the one, however, being treeless, and the other being timber clad, the latter will absorb of the water which falls and of the snow which melts, about three fourths more than the former."

"Does it pay to allow pigs to run on pasture?"

Much will of course depend upon the character and quality of the pasture, and a good clover sod will give us a very different answer from an old sward of natural grass; one of our experiment stations, after several tests, gives the following report:

1. Pigs allowed to run at large over 18 acres of good pasture and fed a full ration of grain, made the most rapid growth, and required the least grain for one pound of gain.

2. Pigs confined in movable pens in the pasture grew more slowly than those running loose, and required an increase of 20 per cent. of grain to make one pound of growth.

3. Pigs at pasture, fed under three different conditions, gained 92.5 per cent. more and ate but 2 per cent. more than pigs getting grass and otherwise similarly fed, but confined in pens.

4. Pigs fed but part rations of grain at pasture made satisfactory gains. Those at pasture getting the three-fourths grain ration, gained more than those fed a full grain ration and grass, either in the yards or in the pens.

5. Pigs pastured without grain made about the same growth for three seasons in succession, this averaging 0.36 pounds per day.

6. As nearly as can be judged, exercise alone increased the gain 22 per cent. and the quantity eaten but 1.5 per cent., but decreased the quantity required for one pound of gain 22 per cent.

7. Grass when cut and fed green to pigs, whether fed in pens or yards, or with full or part grain rations, or without grain, proved to be of very little value.

8. Pigs confined in pens and fed grass alone, mostly alfalfa, for 91 days, lost over one-quarter of a pound per day.

9. The average of pigs fed on grass gained a little more than those without the grass, but not enough to pay for the extra feed in the grass.

10. With pigs confined in the hog-house pens, the grass proved beneficial, while with those in the yard it proved detrimental, the latter requiring more grain to make a pound of pork with grass than without it.

11. Pasturing, either with or without grain rations, appeared to be by far the cheapest and best way of making pork.

"What is 'rural free mail delivery,' of which Secretary Edge spoke this morning?"

It is the result of an experiment by the Government of delivering the mail of farmers in thickly settled districts at his door, in a manner similar to that pursued in cities of or above a certain size all over the United States. Congress made an appropriation of $10,000 for the purposes of the first experiment; this proved so successful that a further appropriation of $30,000 was granted, and this has, for the past year been increased to $50,000.

A number of experimental routes were from time to time established, and have thus far shown that the plan is feasible and economical in thickly settled agricultural districts, especially around and near our larger cities. One route was established in Lancaster county; the distance traveled by the carrier was from 16 to 20 miles daily.

The report of the Postmaster General furnishes us with the following items of information:

There were 84 carriers started in 44 states, and the average cost of the delivery of each piece of mail has been 1.68 cents; the population served by these 84 carriers was 22,772, and the number of pieces of mail delivered from October, 1896, to June 30, 1897, was 836,308. The average amount paid the carriers was $283.61 per year; the average area covered by each carrier was 20.93 miles, and the average number of miles traveled daily was 22.

The Postmaster General thus reports in relation to the experiment:

"According to the varying conditions of the country traversed, the rural carriers perform their services on horseback, or riding in buckboards, buggies, two wheeled carts or on bicycles. In some states

they have to cross farms and pull down bars and ride over some fields to deliver and collect mails. In no instance has any serious complaint been made of this invasion of private rights. On the contrary, the co-operation of the communities served, in every instance, has been cheerfully and effectively given. The farmers, at their own cost, have put up boxes at cross-roads and at other convenient places for the reception of their mails."

The same report also states that in some communities an arrangement has been made with the carrier by which he collects and takes the outgoing mail to the postoffice, and that, in a number of cases, the families pay the carrier $2.00 per year each for this service.

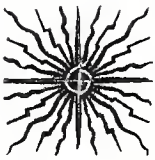
"How much weight do pigs lose in killing and dressing?"

Much will, of course, depend upon the condition of the animal as to fatness, the loss being greater in lean animals than in better fattened ones.

The following is a tabulated result of the careful weighing and killing of eleven medium weight animals:

	Live. lbs.	Dressed. lbs.	Loss. lbs.
1,	230	179	52
2,	240	190	50
3,	240	190	50
4,	240	190	50
5,	235	185	50
6,	223	178	45
7,	230	185	45
8,	230	185	45
9,	205	161	44
10,	225	181	44
11,	215	175	40
	2,513	1,999	515

In order to ascertain the loss by smoking, the meat of these pigs was salted for ten days, then taken up and again salted for ten days more; after all the pickle had dripped and dried off, the meat was again weighed, and then smoked, and it was found to have lost five and one half pounds in each hundred of green meat.



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COMMONWEALTH OF PENNSYLVANIA.

DEPARTMENT OF AGRICULTURE.

BULLETIN NO. 40.

QUESTIONS AND ANSWERS

RELATING TO

Agricultural and Horticultural Subjects.

BY

THOS. J. EDGE, *Secretary*,
DEPARTMENT OF AGRICULTURE,
HARRISBURG, PA.

WM. STANLEY RAY,
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